NATIONAL
FRUIT AND CIDER INSTITUTE,
LONG ASHTON,
NEAR BRISTOL.

REPORT
FOR THE YEAR
1907.

BATH:
PRINTED BY WILLIAM LEWIS AND SON, 12, NORTH GATE.

The National Fruit and Cider Institute

LONG ASHTON, NEAR BRISTOL.

REPORT OF THE GOVERNORS

To the Fifth General Meeting of Governors, Members and Associates, to be held in the Council Pavilion of the Bath and West and Southern Counties Society, Show Yard, Dorchester, on FRIDAY, May 29th, 1908, at 2.15 p.m.

Governors of the Institute:

ACLAND, Sir C.T. DYKE-, Bart. (Chairman)
BAKER, G. E. LLOYD-
BIFFEN, R. H.
BUNYARD, G.
COOKE, C. W. RADCLIFFE-
DAVIS, HERBERT J.
DYSON, GIBSON.
ELLIOTT, Sir THOMAS, K.C.B.
GIBBONS, H. H.
GRANT, W. J.
GRENVILLE, R. NEVILLE-
HOBHOUSE, RIGHT HONOURABLE H.
HUNT, A. E. BROOKE-
MATTHEWS, HENRY
NAPIER, H. B.
OSBOURNE, J. S. SMYTH-
RILEY, JOHN
SHELLEY, Sir JOHN, Bart.
SILLIFANT, A. O.
SLATTER, JAMES
SMITH, J. W.
WATTS, JAMES
WHEELER, E. VINCENT V.
WILLIAMS, T. W.
WOOTTON, JOHN H.

Managing Committee:

NAPIER, H. B. (Chairman)
COOKE, C. W. RADCLIFFE-
GRENVILLE, R. NEVILLE-
HUNT, A. E. BROOKE-
OSBOURNE, J. S. SMYTH-
SLATTER, JAMES.
WATTS, JAMES

Members:

ACLAND, Sir C. T. D., Bart. Killerton, Exeter.
AMORY, LUDOVIC H. Knightshayes Court, Tiverton.
BAKER, G. E. LLOYD-. Hardwicke Court, Gloucester.
BALLARD, F. The Winnings, Colwall, Herefordshire.
BERKELEY HUNT AGRICULTURAL SOCIETY. Berkeley, Gloucester.
BIFFEN, R. H. The Gables, Histon, Cambridge.
BOND, E. W. Hele, Cullompton, Devon.
BULMER, E. F. Ryelands, Hereford.
BULMER, H. P. Ryelands, Hereford.
BUNYARD, G. Royal Nurseries, Maidstone.
CADDICK, E. W. Caradoc, Ross, Hereford.
CAREW, C. E. POLE-. Parkhill, Littlehempston, Totnes.
CHAPMAN, G. F. Draycott, Somerset.
CHEVALLIER, J. B. Aspall Hall, Debenham, Suffolk.
CHILDS, CHRISTOPHER. Boscarn, Love, R.S.O., Cornwall.
COOKE, C. W. RADCLIFFE-. Hellens, Dymock, Gloucester.

Members *(continued).*

Crossman, Henry. Ham Farm, Yatton, Somerset.
Davis, Herbert J. Hurlingpot, Shepton Mallet.
Dowden, J. Mostyn. Messrs. Dowden & Pook, 41, Bermondsey Square, London.
Durham, H. E. (Dr). Clovelly, Tower Road, Hereford.
Dyson, Gibson. Brockhall, Leominster.
Elliott, Sir Thomas H., K.C.B. Board of Agriculture and Fisheries, 4, Whitehall Place, S.W.
Ellis, Henry Arthur. Highman, Gloucester.
Farwell, E. W. 11, Laura Place, Bath.
Fletcher, E. Hazeldine, Rydes Hill, near Guildford.
Gaymer & Son, Ltd. Attleborough, Northampton.
Gibbons, H. H. Church Farm, Clutton, Bristol.
Goodall, The Revd. R. W. Kempley Vicarage, Dymock, Gloucester.
Grant, W. J. County Council Offices, Newport.
Grenville, R. Neville-. Butleigh Court, Glastonbury, Somerset.
Grew, James. Co. Armagh Cider Co., Portadown, Ireland.
Haydon, H. Courtenay. Chettiscombe, Tiverton, Devon.
Hinckes, R. T. Foxley. Hereford.
Hobhouse, Rt. Hon. H. Hadspen House, Castle Cary, Somerset.
Hunt, A. E. Brooke-. Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.
Jeffrey, Robert. The Throsk, Succoth Place, Murrayfield.
Keel, Walter W. Stanton Drew, Bristol.
Lethbridge, Sir Roper. Exbourne Manor, Exbourne.
Lloyd, F. J. Muscovy House, Trinity Square, London, E.C.
Mann, Felix. 127, Fenchurch Street, London, E.C.
Marshall, L. H. Chippenham, Wilts.
Matthews, Henry. Winterbourne, Bristol.
Mid-Somerset Agricultural Society. Shepton Mallet.
Mole, H. B. Shepton Mallet, Somerset.
Monmouthshire Chamber of Agriculture. Newport.
Morris, Mrs. Lizzie. 147, Harley Street, London.
Napier, H. B. Estate Office, Long Ashton, Bristol.
North Somerset Agricultural Society. Yatton, Bristol.
Osborn, C. Woolston, North Cadbury, Somerset.
Osbourne, J. S. Smyth-. Ash, Iddesleigh, N. Devon.
Pickering, P. S. M. Woolacombe, Devon.
Porter, W. J. H. Glendale Farm, Wedmore, Somerset.
Power, Thomas. Dungarvan, Waterford, Ireland.
Preece, Thomas. Old Hall, Ross, Hereford.
Price, M. Philips. Tibberton Court, Gloucestershire.
Pulling and Company. Bath Street, Hereford.
Rich, M. W. Sandford, Bristol.
Ricketts, E. E. Cape Hall Farm, Stonehouse, Gloucester.
Riley, John. Putley Court, Ledbury.
Royal Jersey Agricultural Society. Jersey.
Shelley, Sir John, Bart. Shobrooke Park, Crediton, Devon.
Sherston, Major C. D. Evercreech, Bath.
Sillifant, A. O. Culm Leigh, Stoke Canon, Exeter.
Slatter, James. Paxford, Campden, Gloucester.
Smith, J. W. Thinghill Court, Hereford.
Stooke, J. E. Hellyar. 2 Palace Yard, Hereford.
Somerset County Agricultural Association. Taunton.
Studdy, T. Upper Bordean, Petersfield, Hants.
Sutton, Leonard G. Hillside, Reading.
Taunton Deane Horticultural and Floricultural Society. Taunton Deane, Somerset.

Members *(continued).*

THOMAS, Lieut.-Col. AUBREY. Overross, Hereford.
TILLEY, W. T. S. East Compton, Shepton Mallet.
WALKER, E G. F. The Hollies, Chewstoke, Bristol.
WALKEY, C. E. J. Edgeborough, Staplegrove, Taunton.
WARDLAW, H. Holway Farm, Sherborne, Dorset.
WARREN, RICHARD, A. Belle Vue, Harrow Road, Worcester.
WATTS, JAMES. Backwell, near Bristol.
WHEELER, E. VINCENT V. Newnham Court, Tenbury, Worcestershire.
WHITEWAY, HENRY. Fordron House, Whimple, Devon.
WILLIAMS, T. W. Bank Chambers, Corn Street, Bristol.
WOOTTON, JOHN H. Byford, Hereford.

Associates:

ALLEN, J. D. Springfield, Shepton Mallet.
ALLISON, J. B. Rock Villa, Burrowbridge, Bridgwater.
BATTEN, GEORGE. Rosebank, Pensford, Bristol.
BIRD, WILLIAM. The Nest, Overndale Road, Fishponds, Bristol.
BRITTEN, J. E. Old Wood, Tenbury, Worcester.
BROOK, CHARLES. Marksbury, Somerset.
CARTER, FREDERICK J. Failand Farm, Failand, Bristol.
CAZALET, R. H. The Bannut Tree House, Castlemorton, Malvern, Worcester.
CHAPMAN, WALTER. Hewish, Bristol.
COCKS, A. H. Poynetts, Skirmett, near Henley-on-Thames, Oxon.
CROFTS, JOHN. Sutton Montis, Sparkford, Somerset.
GILES, JOHN. Portbury, Bristol.
JONES, GEORGE. Wood Farm, Welland, Ma vern.
LANGFORD, E. W. Wyebridge Stores, Hereford.
MCCREATH, W. D. Quantock Vale Cider Works, North Petherton, Bridgwater.
PLAYER, E. N. 60, Alma Road, Clifton, Bristol.
POPE, JOHN M. Spence Combe, Copplestone, Devon.
PRETTY, W. H. 4, The Terrace, Shirehampton, Bristol.
RIDLER, R. E. Clehonger Manor, Hereford.
RIPLEY, E. G. Beaston House, Bucknall, Shropshire.
STONE, THOS. Wine and Cider Merchant, Axminster.
SYMES, J H Coat Farm, Martock, Somerset.
SUTTON, WILLIAM LINCOLNE. Eaton, Norwich.
TAVENER, GEORGE E. Budlake, Broadclyst, Devon.
THOMPSON, ERNEST H. Gilmorton, Tenbury, Worcester.
TUCKETT, PHILIP D. Netherton, near Newton Abbott.
TUDWAY, C. C. Wells, Somerset.
WESTON, HENRY. Bounds Farm, Much Marcle, Hereford.
YELLAND, W. D. Nethercot, Iddesleigh, Devon.

Resident Director:

P. T. P. BARKER, M.A. The National Fruit and Cider Institute, Long Ashton, Bristol.

Superintendent of Fruit Department:

J. ETTLE, F R.H.S. Stanley Grove Road, Weston-super-Mare.

Hon. Treasurer:

H. B. NAPIER. Estate Office, Long Ashton, Bristol.

Hon. Secretary:

W. J. GRANT. County Council Offices, Pentonville, Newport, Mon.

REPORT BY THE GOVERNORS.

1. The Governors beg to submit to the Members the following Report on the work of the Institute during the past year.

2. The Institute has been founded and is maintained by the following Bodies :—

The Board of Agriculture and Fisheries.
The Bath and West and Southern Counties Society.
Devon County Council.
Gloucester County Council.
Herefordshire County Council.
Monmouthshire County Council.
Somerset County Council.
Worcestershire County Council.

Members and Associates.

3. Since the formation of the Institute, new Members and Associates have been enrolled each year, and the Governors hope that as the work and objects of the Institute become more widely known there will be a steady increase in the number of both Members and Associates.

4. In accordance with Article 30 of the Articles of Association, the following Governors retire :—

Governor.	By whom appointed.
Mr. A. E. Brooke-Hunt .	. Board of Agriculture and Fisheries.
Mr. H. B. Napier . .	. Bath and West Society.
Mr. C. W. Radcliffe-Cooke	. Hereford County Council.
Mr. G. E. Lloyd-Baker .	. Gloucester County Council.
The Rt. Hon. H. Hobhouse .	. Somerset County Council.
Mr. E. Vincent V. Wheeler	. Worcester County Council.
Mr. John H. Wootton .	. Members and Associates.
Mr. Gibson Dyson . .	. Governors.

These Governors are eligible for re-nomination by the various Bodies whom they represent.

Advantages of Institute.

5. The Governors and Managing Committee wish to impress upon the Counties concerned, and upon all persons interested in the important industry of Cider-making the advantages of the opportunity now placed at their disposal, through the formation of the Institute, by means of which they may obtain advice and assistance bearing upon this

industry, either by personally visiting the Institute, or by sending their sons there to receive instruction, scientific and practical, not only in Cider and Perry-making, but also in the growth of fruit and the production of fruit trees.

Terms.

6. Students can be received on the following terms :—

Scientific instruction in the Laboratory :

Four guineas for one month's instruction ; or

Ten guineas for three months' instruction.

Working pupils from subscribing Counties can be received at the Institute for a period of not less than one year for instruction upon Fruit-growing, and to work upon the Farm. Pupils to receive a wage of 7s. 6d. per week from the Institute, the Counties sending the pupils to contribute a Scholarship of £20 per annum.

University College, Bristol.

7. In addition to the advantages already mentioned, arrangements were made last year with the University College of Bristol for a conjoint course of instruction in Fruit-growing and Cider-making (including research on Cider ferments) to which the interested bodies and counties are entitled to send one student free of charge for this special course.

Distribution of Cider Apple and Perry Pear Trees.

8. Each of the Bodies and Counties contributing to the Institute will, in November next (1908) have an opportunity of receiving 300 young standard cider apples, this number (300) to include if required a certain number of standard Perry Pears for the purpose of establishing, what might be termed, the best examples of Cider and Perry Orchards in the cider producing counties.

Members and Associates will have the opportunity of purchasing trees, should there be any to spare, at prices to be fixed by the Managing Committee.

Practical Work.

9. In October and November, 1907, the Cider-making months, a large number of all those interested in the West country industry of Cider-making from the counties of Devon, Gloucester, Hereford, Monmouth, Somerset, and Worcester availed themselves of the opportunity of visiting the Institute.

Inspection of Institute, Nursery and Fruit Plantation.

10. Since the last report the Institute has been inspected by those who are interested both in the Cider industry and Fruit Culture from many counties, all of whom seemed to be thoroughly impressed with the very practical and thorough

manner in which the making of Cider was carried out, and also in the production of the best Cider Apples and Perry Pears, which are being grown in the Nursery attached to the Institute.

Tasting Cider and Perry.

11. A large and thoroughly representative gathering from each of the Counties already named responded to the invitation issued to be present at the Institute on Thursday, May 7th, 1908, for the purpose of both seeing the work that was being done, and tasting the Perry and Cider made from fruit grown in the above counties. Mr. Barker, the Director, after the tasting, gave to an interested audience, an object lesson of considerable value on the various yeasts that are desirable or otherwise in the successful fermentation of Cider or Perry, this being original research work to which Mr. Barker has given special attention.

Conference.

12. A very instructive Conference took place at the Church House, Long Ashton, on the 8th May. In the morning a paper was read by Mr. W. J. Grant, entitled " The Planting of a Cider Orchard," and a very useful discussion followed. In the afternoon a paper was read by Mr. B. T. P. Barker, entitled " A Standard for Cider," and again a very interesting discussion followed, and on the motion of Mr. E. G. F. Walker it was unanimously resolved to ask the Government, through the Board of Agriculture, to receive a deputation on the question of establishing a Cider Standard.

The various County Horticultural Instructors attending the Conference having expressed a desire to have copies of Mr. Grant's paper, the Committee of the Institute have decided to have it printed, and application for copies should be made to Mr. Grant, the Hon. Secretary.

Object Lesson.

13. With a view of extending the usefulness of the Institute, arrangements were made by which exhibits from an educational standpoint were sent to—

Bath and West and Southern Counties Society, Newport
Berkeley Hunt Agricultural Society's Show.
Brewer's Exhibition, London.
Devon County Show.
Hereford and Worcester Agricultural Society's Show.
Mid-Somerset Agricultural Society's Show.
Somerset County Agricultural Society's Show.
East Somerset Agricultural Society.
Taunton Deane Horticultural Society.

Adulteration of Cider.

14. The President of the Board of Agriculture and Fisheries (the Earl of Carrington), in fulfilment of his promise to make use of the information laid before him by the Deputation introduced by Sir C. T. Dyke-Acland, Bart. (Chairman of the Governors) on the 6th May, 1907, has through the Board of Agriculture and Fisheries been giving attention to the adulteration of Cider, the Board, have obtained convictions, with heavy penalties, for the sale of a liquid called Cider that did not contain apple juice.

Railway Rates for Cider Fruit.

15. The Managing Committee are still giving attention to the question of the high rates charged by Railway Companies for the carriage of Cider Apples and Perry Pears, but the Committee would point out that the question of railway rates is a matter that can be most effectually dealt with by the concerted and combined action of both the Growers and Purchasers.

16. The Governors take this opportunity of requesting all who are either interested in the Institute, or in the work it is doing, to use their influence in urging others to become Members. Members' subscriptions are one guinea per annum, for which they receive all the literature published by the Institute, and can have either six varieties of Apples or Pears or six kinds of Cider or Perry analysed each year. Associates have the same privileges, with the exception that they are unable to vote at the Annual Meeting; while both Members and Associates can visit the Institute and obtain advice from Mr. B. T. P. Barker, upon all matters in connection with the Cider industry.

17. In the Appendix will be found a reprint from the last "Journal" of the Bath and West and Southern Counties Society, containing Reports upon the National Fruit and Cider Institute, from Messrs. B. T. P. Barker and J. Ettle.

W. J. Grant,
Hon. Sec.

THE NATIONAL FRUIT AND CIDER INSTITUTE.

REVENUE ACCOUNT FOR THE YEAR 1907.

	£	s.	d.	£	s.	d.
To SCIENTIFIC STAFF AND EXPENSES—						
Barker B. T. P., Salary	300	0	0			
Lloyd F. J., Honorarium	50	0	0			
Sundry Expenses	19	10	0			
				369	10	0
To RENTS, RATES, etc.—						
Ashton Court Estate, Rent	80	0	0			
,, Interest on Loan	10	10	3			
Rates and Taxes	22	16	3			
Insurance	2	8	3			
				115	14	9
To MANAGEMENT—						
Auditors, Accountant and Correspondents	13	7	3			
Stationery and Printing	23	8	0			
Sundry Expenses	20	5	6			
				57	0	9
To ORCHARDS, PLANTATIONS AND NURSERY—						
Stock from last year	530	7	4			
Wages	188	12	1			
Trees	32	18	10			
Manure	8	18	9			
Fruit Superintendent's Honorarium and Expenses	53	1	2			
Sundry Bills and Expenses	30	15	1			
	844	13	3			
Less Stocks carried forward	780	1	6			
				64	11	9
To CIDER MAKING—						
Stock from last year	141	19	0			
Wages	53	8	10			
Cider Fruit	76	12	9			
Carriage and cartage	26	17	4			
Sundries	8	8	0			
	307	5	11			

	£	s.	d.	£	s.	d.
By Balance brought forward				565	16	0
By GRANTS—						
Board of Agriculture	300	0	0			
Bath and West of England Society	100	0	0			
Devon County Council	100	0	0			
Gloucester County Council	100	0	0			
Hereford County Council	100	0	0			
Monmouth County Council	50	0	0			
Somerset County Council	100	0	0			
Worcester County Council	100	0	0			
				950	0	0
By AFFILIATION FEES.						
Berkeley Hunt Agricultural Society	1	1	0			
Bristol University College	1	1	0			
Mid-Somerset Agricultural Society	1	1	0			
Monmouth Chamber of Agriculture	1	1	0			
North Somerset Agricultural Society	1	1	0			
Royal Jersey Agricultural Society	1	1	0			
Somerset Agricultural Society	1	1	0			
				7	7	0
Members' Subscriptions				64	1	0
Associates' Subscriptions				5	0	0
By SALES—						
Cider	96	17	10			
Fruit	54	12	7			
Packages not returned	15	1	7			
Making Cider, etc.	2	2	3			
				168	14	3
By MISCELLANEOUS—						
Grazing rent	37	0	0			
Pupil's Fee	5	5	0			
Contribution towards Devon Show Expenses	2	2	0			
				44	7	0

Laboratory Fittings	13 15 1				
Machinery, Plant, etc.	46 0 8				
Buildings	73 18 10				
		133	14	7	
To MISCELLANEOUS EXPENSES—					
Cider Makers' Association	1 1 0				
Wages	1 11 6				
Show Expenses	12 18 2				
Sundries	14 18 0				
Bank Charges	5 19 1				
		36	7	9	
Balance carried forward		852	3	9	
		£1,805	5	3	£1,805 5 3

Balance Sheet, December 31st, 1907.

Liabilities.

	£	s.	d.
LOAN ACCOUNT—			
Balance due to Lady Smyth	229	2	0
REVENUE ACCOUNT—Balance	852	3	9
DUE TO BANKERS	391	2	0
	£1,472	7	9

Assets.

				£	s.	d.
PROPERTY ACCOUNT—						
Buildings				295	15	5
Laboratory fittings				55	0	6
Machinery, Plant, etc.				184	2	8
				534	18	7
STOCKS—						
Nursery	780	1	6			
Cider	131	4	0			
				911	5	6
Sundry Debtors				26	3	8
				£1,472	7	9

NOTE.—The Nursery Stock is included in the above Balance Sheet at its Market Value, but it is to be noted that a large proportion of it will, by arrangement, be distributed *free* to the various bodies contributing to the funds of the Institute.

In accordance with the provisions of The Companies' Act, 1900, we certify that all our requirements as Auditors have been complied with, and in our opinion the above account is properly drawn up to exhibit a true and correct view of the Institute's affairs as shown by the Books.

(Signed) CURTIS JENKINS & CO.,

17th February, 1908. *Chartered Accountants.*

APPENDIX.

REPORTS BY B. T. P. BARKER, M.A., *Director*,

AND

J. ETTLE, F.R.H.S., *Superintendent of Fruit Department.*

REPORT BY B. T. P. BARKER, M.A.

THE EXPERIMENTAL CIDER WORK.

The present Report contains for the most part an account of the work carried on at the Institute during the cider-making season of 1906-1907. The varieties of apples obtained for experimental purposes were the following :—

Sharp Varieties.—Ashton Egg Crabs, Ashton Long Pods, Backwell Red, Brice's Kernel, Cap of Liberty, Cowarne Red, Dufflin, Frederick, Kingston Black, Lambrook Pippin, Langworthy, Page's Yellow, Pople's Gutter, Skyrme's Kernel, Tom Putt, Yellow Styre.

Sweet Varieties.—Ansell, Ashton Brown Jersey, Bell, Cremière, Cluster Jersey, Davis' Favourite, Douce Amère, Frequin de Chartres, Greasy Redstreak, Loram's Sweet White, Muscadet, Noir de Vitry, Northwood, Sweet Alford, Symes' Sweet, Woodbine.

Bitter-Sweet Varieties.—Ashton Bitter White, Ashton Early Red Jersey, Ashton Russet Jersey, Ashton White, Cardive Forestier, Cherry Norman, Chisel Jersey, Counsellors, Dabinet, Frequin Rouge, Horners, Major, Master's Jersey, Medaille d'Or, Mons. Jacques, Prince Albert, Pytheres, Crofts' Redstreak, Royal Wilding, Strawberry Norman, White Norman, Yarlington Mill.

The Single-Variety Characters.—Cider was made, as in previous seasons, from each of these varieties separately, in order to ascertain the particular character of each individual variety for cider-making purposes, and to compare the behaviour of certain varieties in different seasons and from different soils, in those instances where the variety had been previously examined. Detailed accounts of these ciders will be found on pp. 26, *et seq.*

The aims of these single-variety tests have been to ascertain in the first place what variety-characters are important for vintage purposes ; to determine the value of the varieties examined ; to see how far it varies in fruit grown under different conditions, and to select the most valuable kinds for propagation. The most important vintage characters have been stated in the second Annual Report, and subsequent experimental work has confirmed the earlier results.

With regard to one of those characters, viz., the characteristic flavour of the variety, it may be stated, after considerable experience with a large number of varieties, that this factor is much more pronounced with sharp varieties than with sweet or bitter-sweet kinds. Most of the ciders made from sharp varieties are entirely distinct in flavour, although the general chemical composition of many of them is very similar. The difference is very well illustrated as being due to the "flavour of the acid," an apt, although probably incorrect, expression, used by some who have tasted the samples. The use of different kinds of sharp apples for blending, therefore, has a considerable effect upon the flavour of the cider, even though the percentage of acidity is brought to practically the same point in each blend.

Sweet and bitter-sweet varieties do not show for the most part such striking variations in flavour. There are generally perceptible differences in single-variety ciders made from each of these two classes of fruit, especially when the rate of fermentation is widely different in the respective cases; but, from a practical point of view, varieties belonging to these classes can usually be substituted for one another in blends without materially changing the flavour of the blend; provided that their composition, as regards acidity and tannin, and their rates of fermentation, do not vary appreciably. Since the experimental work has now established the characters of apples of most importance for vintage purposes, and at the same time has provided a certain amount of data as to the fluctuations in these characters in the same variety grown under different conditions, it is now becoming possible to make progress with the task of ascertaining which varieties are worth keeping in cultivation, and which, as being of little or no value, may be allowed to die out. The cider-maker of the future will require to have the maximum amount of control over the nature and quality of his products; and with that end in view it is necessary to substitute a limited number of varieties of known character and of the highest quality for the existing host of varieties, the great majority of which are almost unknown, and of whose value for cider purposes there is complete ignorance. Possibly the number kept in cultivation might profitably be cut down to about fifty. At any rate, twice that number should furnish abundant choice to suit every requirement. The system which is being followed at the Institute is to select, from the varieties tested, a few of the most promising members of each of the required classes, viz., representatives of sharp, sweet and bitter-sweet kinds, including early, mid-season and late sorts

of each type. The selected varieties are being propagated in the nursery at the Institute, so that a number of trees of each kind may be available as soon as possible for further tests as to their suitability for different soils. These can be considered for the time being as sorts which are worthy of further propagation; although it is extremely likely in many instances, if not in every case, that a better acquaintance with some of the little known or unnamed varieties will lead to the discovery of superior kinds, which can then in turn be given the preference for cultivation. Details as to varieties, which can already be recommended for planting, may be obtained upon application to the Institute, and in most cases grafts or buds of these sorts can be supplied. Work upon these lines promises, in the course of a few years, to provide the cider grower with a selection of varieties which will not be inferior in any respect to the standard French sorts,—at present perhaps generally regarded as being the best in the world for cropping and for richness of juice,—and will probably be superior to these, from an English point of view, as regards the quality and flavour of the cider. Some of the best known varieties have proved to be worthy of their reputation; but, generally speaking, the majority of the well-known and widely grown kinds have been found to be somewhat disappointing, being deficient either in quality of flavour or richness. The most promising results have been met with among the little known and purely local varieties. As illustrations of the degree of richness of juice of certain varieties of this description the following examples, taken from last season's results, may be quoted, and will serve to show the possibilities of improvement of cider by careful selection of varieties by the grower :—

Name of Variety.	Specific Gravity of Juice.	Percentage Composition of Juice.		
		Total Sugar.	Malic Acid.	Tannin.
Butleigh No. XIV.	1.092	20.89	.20	.432
Dufflin	1.072	15.41	.91	.198
Tanner's A.	1.077	17.19	.24	1.180
Yellow Styre	1.075	15.91	.49	.148
Pole-Carew's No. X.	1.089	19.56	.39	.374
Ashton No. 146	1.085	18.49	.63	.096
Do. No. 197	1.088	19.21	1.00	.150

These results may be better appreciated, when it is pointed out that the specific gravity of the juice from average quality varieties is 1.050—1.055, and the percentage of sugar 10—12.

Experiments on Practical Methods.

In addition to the general work with single-variety ciders, experiments were carried out last season in connection with the storage of cider fruit; the blending of fruit or fresh juice as opposed to the blending of the ciders at a later stage; the influence of the type of mill and press used in grinding the fruit and expressing the juice; the immediate pressing of the pomace, as compared with the maceration for a length of time before pressing; methods of management of the fermenting cider; the influence of the size of the cask used for containing the fermenting liquor, and the general effect of aëration on the fermentation; the most suitable time at which to filter, and the possibility of improving ciders of poor quality.

The Storage of Cider Fruit.—Before considering the experiments on this subject, it is highly desirable to draw in an emphatic manner the attention of all interested in the culture and purchase of cider fruit to the extreme importance of the fruit being gathered, and stored, in the most careful manner. Although every endeavour has been made to obtain fruit in a sound and good condition for the purposes of the experimental work at the Institute, it has been sent by the growers in many cases in a most unsatisfactory state, the fruit being bruised, rotten, wet, of unequal ripeness, and otherwise in bad condition. In certain cases no one could expect to make even a passable cider from the fruit, in spite of its being first picked over carefully, all rotten and unsound fruit rejected, and the remainder well washed. In such samples the juice had a tainted flavour from the press, and no care in the after management could remedy this initial defect. Complaints of the same trouble have been repeatedly received from makers who depend for their supply of fruit mainly upon its purchase from the grower; and it is evident that there must be a very considerable annual loss to the industry as a whole, solely because the grower fails to exercise a reasonable amount of care in the gathering and consignment of the fruit. Probably an improvement in this matter could be effected if the larger purchasers were to take joint action and refuse to accept delivery of all fruit sent in bad condition, or, at the least, were to pay a reduced price for it. Those growers who regularly devote care and attention to the fruit would thus be more fairly treated, and others would be encouraged to follow their example.

The storage of fruit for cider-making purposes has not hitherto received much attention. The method adopted is usually determined by the conveniences at the disposal of the maker.

Those who grow their own fruit frequently allow it to fall from the trees as it ripens, and then gather it into heaps on the grass in the orchard, where it remains until the heap is large enough to make a cheese or until it is convenient to bring it to the press. It is also the custom of many makers who are obliged to purchase their fruit, to store it out of doors in heaps on grass until they can deal with it. Others prefer to store it under cover, usually in a loft. Others again, who have limited quantities to deal with, store it in the open in hurdle stores, which may or may not be covered to keep off rain. There appears to be no general agreement as to the best method of storage, although Continental authorities favour storage under cover, on the ground that the fruit remains drier and can mature under conditions of desiccation, thus tending to produce a higher specific gravity of the juice. The tests carried out at the Institute practically covered all the usual methods. The apples used for the purpose of the experiments were Chisel Jerseys and Lambrook Pippins, in the proportion of two-thirds of the former to one-third of the latter, the respective samples being all taken from the same original lots of fruit. The total quantity of fruit used in each case was half a ton.

In Experiment A the fruit was strewn upon grass in the orchard; which is equivalent to the method of allowing it to remain upon the ground as it falls from the trees.

In Experiment B it was placed in a heap upon the grass in the orchard.

In Experiment C it was placed in an uncovered hurdle store in the orchard, thus being exposed thoroughly to all kinds of weather although not liable to take up any earthy taint through lying upon damp soil.

In Experiment D it was placed in a covered hurdle store, thus exposed to a plentiful supply of air but shielded from rain.

In Experiment E it was stored in a heap in the apple loft, thus being under cover and perfectly dry although not exposed to such free currents of air as the lots stored out of doors.

The results showed that the condition of the fruit at the time of grinding, which took place during the month of December, after four weeks storage, was best in D, and least good in B, although there was not a serious difference between the two extreme cases. The yield of juice was appreciably better from the out-of-doors lots than from E; but the methods determining the yield of juice from a practical point of view were not sufficiently delicate to allow of any conclusive decision as between A,

B, C and D. The specific gravity of the juice in A was 1.0505; in B 1.0535; in C 1.0545; in D 1.0560; and in E 1.0545. The differences in the amounts of solid matter and sugar in the juice corresponded generally with the differences in the specific gravity; but the percentage of acidity was the same in each instance. In A, C, and E the amount of tannin was approximately the same; but in B it was decidedly below, and in D above, the average. The rates of fermentation of the juice did not vary to any appreciable extent, being slow in each case. The ciders were filtered about a month after pressing. They kept sweet and in good condition without much deposit in bottle, although the samples in cask turned sick in every instance towards the end of the following summer. The comparative merits of the respective ciders were not easy to determine. They possessed the same general character and, during the first half of the summer after being made, differed to a very slight extent in flavour. B was, perhaps, considered the best by the majority of those who tasted the samples; but probably the fact that it appeared to mature more quickly and was, therefore, more suited to drink sooner than the others had a great deal to do with the decision. At a later period, however, B was undoubtedly the poorest as regards flavour and general condition, its quality deteriorating considerably in bottle. D was at that stage slightly to be preferred to A and C, while E was a trifle inferior to these.

The weather during the course of the experiments was on the whole good and not very wet. Doubtless the results in another similar series of tests would vary somewhat, if the weather conditions were different. On the whole, the conclusion to be drawn appears to be that the method of storage has no serious influence on the quality of the product, provided that the fruit remains sound and the weather is not too wet or frosty for out-of-door storage. The deterioration in B may probably be attributed to the fact that the fruit did not keep so well as in the other cases. The best method seems to be D, where the fruit is in a free current of air and yet not exposed to rain or slight frosts, or liable to acquire any taint from the soil.

Blending.—It is the usual custom to blend the fruit and not the ciders; and there are many makers who fear to blend ciders during or after fermentation on account of possible disturbances of fermentation arising. Most makers have probably observed that renewed fermentations are sometimes started after mixing two ciders. The general opinion also seems to be that a better cider results from the mixture of the fruit than from the blending of

the ciders made from the same kinds of apples whose juices have been fermented separately. There are, however, several reasons why it is preferable to blend fermenting or fermented ciders rather than the fruit. For example, the kinds of apples and quantities of each available and fit for grinding at a particular time may not be such as would give a juice of suitable composition as regards contents of acid and tannin, *i.e.*, a palatable cider when fermented ; but this drawback could be overcome by blending at a later stage with the juice or cider from later ripening apples of the desired type. Two series of experiments were, therefore, carried out to determine, if possible, whether the blending of ciders did actually yield an inferior product. In the first Pytheres, a mild bitter-sweet variety, and Langworthy, a medium sharp variety, were used. The fruit of the two kinds was put through the mill separately and the quantity of juice from each lot measured. A full hogshead of each was allowed to ferment separately, and was then filtered, when the specific gravity had fallen to 1.030. Equal quantities of each, sufficient to give a full hogshead of the mixture, were then mixed together and the cask bunged down, sample bottles of the mixture being taken at the same time. In addition, equal quantities, direct from the press, of the fresh juice of each sort were mixed, the blend in this instance being practically equivalent to a mixture of the fruit in those proportions. A hogshead of this mixture was also allowed to ferment ; and was filtered, when the specific gravity reached 1.030. On comparing the ciders for flavour and general condition at different times during the following season, it was generally agreed that the better of the two was invariably the blend of the ciders mixed after fermentation ; although the difference in quality was not considerable, while in character they were essentially the same.

In the second series four varieties were blended, these being Horners, Cap of Liberty, Symes' Sweet and Loram's Sweet White. These were dealt with as in the preceding experiment. The result was similar, there being little actual differences between the two lots, but a slight superiority in quality in favour of the ciders blended after fermentation.

In neither case did any trouble arise through renewed fermentation after blending the fermented ciders. As it happened, the rates of fermentation of the respective juices were not widely different ; and hence there was little risk in blending at that stage. It is in cases when cider made from a rapidly fermenting juice is blended with a sweet cider made from a slowly fermenting juice that renewed fermentation is likely to set in.

Provided this precaution is observed, it is clear from the above experiments that, as regards flavour and condition of the product, blending done after fermentation is not inferior to blending fresh juice or mixing fruit: and that either method may be adopted without appreciable loss of quality to suit the maker's own convenience. If, for example, lots of fruit are fit to be made up, which, when mixed, yield a juice of satisfactory composition from the chemical point of view, the fruit can be blended directly and all possible trouble with renewed fermentations, owing to mixing at a later stage, can be avoided. If, on the other hand, the composition of the mixed juice does not prove suitable, it can be modified later by blending with a cider of the necessary character without much risk of troublesome after-fermentations, so long as mixtures of ciders with widely different rates of fermentation are avoided.

Mill Tests.—The mills used for pulping cider fruit belong to two types. The commoner type is some form of the "crusher." The fruit in such machines is crushed by rollers into a mass of pulp, containing fragments of various sizes of the fruit, and may or may not have been roughly broken up before passing to the rollers. The other type, which is of more recent origin, and almost new to this country, is the "grater." In this case the fruit is pulped up into an exceedingly fine state of division by the action of a rapidly revolving drum, having slightly projecting steel teeth. The mill in use at the Institute is of this type. Since the ciders made at the Institute have frequently been noticed to possess a peculiar twang of bitterness and a less soft character than those made from similar fruit ground by "crusher" mills, it became a matter of importance to ascertain how far the type of mill influenced the nature of the product. By the kindness of Messrs. Osborn & Son, a cheese of Harry Masters apples was made with the use of their gun-metal crushing mill on the same date as a cheese of the same variety, taken from the same original lot of apples, was made up with the "grater" mill pomace. The juice, which was extracted from the crushed pomace with a hydraulic press, was at once forwarded by rail to the Institute, where it was kept and allowed to ferment under similar conditions to the juice from the "grated" pomace, expressed by a steam-power press. The ciders were afterwards treated exactly alike. The chemical composition of the fresh juice did not vary greatly as regards acidity, sugar content and specific gravity; but the amount of tannin in the "grater" juice was perceptibly higher than in the "crushed" juice, while the amount

of mucilage and pectic substances was only about two-thirds as great. There was also a decided difference in the taste of the juices, that from the "crushed" pomace being softer and not so bitter on the palate, thus confirming the differences noted in the chemical composition. The comparative merits of the ciders varied with age. Before midsummer the "crushed" sample was slightly superior to the other; but, later, the positions were gradually reversed, the softer and fuller flavour of the former in its early stages appearing by degrees to change, in the bottled samples, to a slightly unsound character and taste, by the side of which the latter appeared much cleaner to the palate. How far such changes were due to the greater percentage of mucilaginous substances and extractives is uncertain; but there is a certain amount of evidence available from this and other experiments, which seems to indicate that these substances may have an important influence.

Subsequent experiments of a similar nature were carried out at the Institute, the varieties used being Ansell, Dabinet and Pople's Gutter apples. The "crusher" mill used in these instances was a hand-mill, with iron arms to break the fruit roughly and stone rollers to crush it afterwards. The results with these confirmed those obtained with the Harry Masters variety.

It appears, therefore, that the kind of mill used has a decided influence upon the character of the product, the advantage on the whole remaining probably with the "grater" type on the ground of the larger yield of juice more than counterbalancing the slight inferiority in flavour during the spring and early summer.

Maceration.—The experiments mentioned in last season's report as to the comparative merits of the system of allowing the pomace to stand for some hours before pressing, and that of pressing it immediately it comes from the mill, have been completed. The preliminary results there mentioned showed that the specific gravity was generally a fraction higher with the juice from the macerated pomace; that the juice was more easily expressed and the total yield usually rather greater; that the cider tended to clear itself more easily; and that the flavour was somewhat fuller and softer. Further research has shown that these conclusions were on the whole correct, but that the latter feature needs a certain degree of qualification. The flavour was undoubtedly fuller and softer, while the ciders were comparatively fresh; but, with advancing age, the quality deteriorated in the same manner as that just mentioned in connection with the ciders made from "crushed" pomace. A similar explanation may be offered, since macerated ciders contain more extractives than unmacerated. There is no evi-

dence forthcoming from these experiments to show that maceration yields an appreciably richer juice or cider. On that ground therefore the practice certainly does not appear to be justified; while the other advantages hardly outweigh, from a practical point of view, the inconvenience of the method, the greater tendency to deterioration of quality, and the risk of the pomace acquiring a taint through standing more or less exposed in the cider house for several hours.

The Control of the Fermenting Liquor.—One of the most important practical points with which the maker has to deal is the management of the juice during fermentation and the checking or stopping of fermentation. The decision as to the proper time to rack or filter is made difficult by the fact that different ciders ferment at such widely different rates that a simple general rule only holds good in a limited number of cases. When it is recognised that, if fermentation is allowed to proceed until it comes to a standstill naturally, the very large majority of ciders would be absolutely dry, and that many would not cease fermenting or begin to clear until late spring or early summer, but that many of those ciders might be made to retain some degree of sweetness, and be rendered perfectly bright and fit to drink in early spring by the use of a filter, the advantages of a filter are obvious. Its main advantage is the control which it gives over fermentation, either for bringing it to a standstill, or for checking it temporarily. The difficult problem is how to make it of most service; and, for this purpose, information is required as to the degree to which a fermenting cider would proceed naturally. Useful information may be deduced by keeping weekly records of the specific gravities of the ciders during the course of active fermentation. The extent of the fall in specific gravity from week to week shows whether the fermentation is likely to proceed until the cider is dry, or whether it may possibly cease before all the sweetness is lost, the fall being large in the former instance and small in the latter. Such information, however, can only be gained by this method while fermentation is actively proceeding; and in some cases it will not be available until too late to be of most value. In order, therefore, to learn as far and as soon as possible what course and rate the fermentation is likely to take, the following method has been evolved at the Institute and has proved of the utmost service. Small bottles, of about ten ounces capacity, are filled with samples of the fresh juices taken direct from the press, and are placed uncorked in an incubator, kept at a temperature of 80°—85° F, at which degree alcoholic fermentation proceeds most rapidly. The specific

gravity is taken daily until it ceases to fall. The total fall, divided by the number of days elapsing before the completion of fermentation, gives the average daily fall; this figure can be used to represent the comparative rate of fermentation and serves as an indication of the degree to which fermentation, if allowed to proceed unchecked, is likely to be carried in the cider in bulk in the cider house. For instance, some ciders show an average daily fall of ten or twelve or even twenty points, while others do not average more than two, three, or four points per day. The former are examples of rapidly fermenting juices and are suited only for the production of dry ciders; the latter are slowly fermenting liquors and can be utilised, if desired, for the production of very sweet ciders. Definite information can be obtained by this method in less than a week; while a fortnight is sufficient to supply complete details in nearly every case. Thus a knowledge as to the nature of the fermentation of any cider can be obtained, even before that cider has begun to ferment in the cider house. A modification of the method can easily be adopted by any maker, since an incubator is not essential. If the sample bottles are set to stand in any fairly warm place, satisfactory results can be obtained, although the rate of fermentation will be slower; while it is a simple matter to concoct a passable substitute for an incubator, which will serve its purpose well.

With this preliminary knowledge of the rate of fermentation available, the necessary details for the management of the ciders can be arranged according to the principles stated in Leaflet No. III., issued by the Institute; and a measure of control exerted which has hitherto been wanting.

One of the greatest advantages to be gained from it is the possibility of preventing disorders liable to arise in mature sweet ciders. The latter belong to the class of very slowly fermenting juices, and are extremely susceptible to several disorders,—as an example of which cider sickness may be mentioned,—and it is due to the fact that normal alcoholic fermentation comes to practically a complete standstill at a very early stage, that such troubles are able to develop. When, therefore, it is found that certain juices are likely to ferment at an excessively slow rate, it is obviously the wisest plan to blend with them a certain proportion of a more rapidly fermenting juice, so that the rate of fermentation may be brought to a safer limit and the risk of future trouble avoided. Provided that the blend is made intelligently, it is easy to retain sweetness to a reasonable extent in the ciders and at the same time to fortify them against risk of such disorders.

The Influence of Aeration.—It is a well-established fact that air can exercise a considerable influence upon alcoholic fermentation on account of the stimulating effect of the oxygen which it contains upon the yeasts. Thus, it is a common practice for brewers to "rouse" their fermenting beers, so that the air may be brought more thoroughly into contact with the yeast and, consequently, the vigour of fermentation increased as a result of the increased multiplication of the ferments which follows. In the case of cider this influence appears at first sight as if it might be almost negligible, since the general aim of the maker is to expose the liquor as little as possible to the air, in order to avoid risk of acetification. Results quoted in last year's Report, however, tended to show that the practice of keeving causes fermentation to begin sooner, and proceed more rapidly for a time, in a juice thus treated, than in the same kind of juice not keeved, on account of the increased surface of the liquor exposed to the air. Further experiments on this point have yielded similar results, and there can be no doubt now that fermentation is temporarily stimulated by keeving. These results also indicated that it might prove worth while to investigate the possible influence of air in this direction at other stages of the fermentation of cider. This was done, and several important facts have been noted in consequence.

For instance, it has been observed that an increased rate of fermentation frequently occurs after racking ciders which are still cloudy; whereas a reduction of the rate should be anticipated, since the object of racking is to check fermentation by the removal of the germs contained in the "grounds." Obviously, therefore, every precaution should be taken, when racking, to expose the cider to air to a minimum extent during the operation; and, not only should the liquor be removed with as little disturbance as possible from the cask originally containing it, but also it should be run as gently as possible into the fresh cask.

A more striking effect of air has been noticed in connection with the casks themselves. When fresh juice, taken from the same original bulk, has been placed in casks of different sizes and allowed to ferment in them without disturbance, it has been found to be the rule that the smaller the cask, the more rapid has been the fermentation. The probable explanation is that the surface area of the cider in contact with the sides of the vessel, as compared with the total bulk of the liquor, is greater proportionately with small than with large casks; consequently the cider in the former case is more affected, bulk for bulk, by the air, which apparently reaches the contents to an

appreciable extent through the junctions of the staves of the cask, than in the latter case.

A very convincing demonstration of the influence of air in increasing the rate of fermentation was seen in some laboratory experiments. Several bottles of the same kind of fresh juice were placed in an incubator at 80° F. The bottles were very narrow mouthed and were filled half-way up the neck, so that the only exposed surface of the liquid was the small area of the mouth. Some of the bottles were left uncorked, so that air was able to reach the liquor in the neck of the bottle. The remainder were corked tightly, and through the cork in each bottle was passed a bent glass tube, opening under water. No air could get to the juice, although the gases given off during fermentation could escape. The specific gravity of the juice in the uncorked bottles fell from 1047 to 1011 in nine days, during which period the specific gravity in the other series fell only from 1047 to 1027. Considering how small a surface was exposed to the action of air in the former series, the results are remarkable, and show that even slight exposure to air is capable of producing marked effects on subsequent fermentation.

Those makers, therefore, who desire to reduce the rate of fermentation as far as possible, must endeavour to avoid any agitation of the juice or cider in contact with air and to prevent any avoidable access of air.

The Time of Filtration.—The results, quoted in last season's Report, of certain experiments to determine the effect of filtration of the fresh juice as it came direct from the press, indicate that, as a general rule, filtration at that stage is of little practical service. Further experiments are in progress, to ascertain at what stage during the course of fermentation filtration can be done most economically and to most practical advantage. The subject requires a somewhat prolonged research, under widely different conditions, in order to yield conclusive results ; but a certain number of statements may be made, which appear to be justified by the evidence at present available.

It is to be understood that the question is considerably affected by that of the type of cider which it is desired to produce. For instance, if a dry cider is required, there is little necessity to consider filtration until fermentation has almost ceased and the liquor is beginning to clear itself naturally. Indeed, it is by no means certain that filtration is desirable in such cases. On the other hand, to produce sweet ciders, filtration at a comparatively early stage in the course of fermentation is generally essential. The

matter has, therefore, been studied, not so much from the point of view of the production of a cider of any particular grade of sweetness or dryness as from that of ascertaining how early in the course of fermentation a cider may be filtered with practical advantage.

It has been clearly proved that this moment depends very largely upon the rate of fermentation. Juices which ferment rapidly cannot be dealt with successfully at such high specific gravities as those which ferment slowly; although actually, in point of time, they may be in fit condition for filtering sooner after making than the latter, on account of the quicker reduction of specific gravity by the more rapid fermentation. It has proved difficult to filter with any permanent advantage rapidly fermenting ciders at specific gravities higher than 1015—1020. About that point fermentation has in some cases been considerably checked and the liquor partially cleared. A second filtration was, however, usually necessary. Probably, in general, little advantage is gained in filtering such ciders at higher points of specific gravity than 1010—1015. Ciders fermenting at a moderate rate can usually be filtered satisfactorily at 1020—1025, a single filtration being all that is necessary in many instances. Slowly fermenting ciders can occasionally be filtered at specific gravities above 1040, especially if the acidity is moderately high; but the degree of sweetness thus attained is unnecessary for ordinary purposes and may render the cider very liable to "secondary" fermentations and other disorders. They may, however, generally be filtered with success at 1030—1035.

The most important conditions in determining the success of filtration appear to be (*a*) that the liquor must be in such a condition that it will pass through the filter with moderate ease and without unduly clogging it; (*b*) that it shall be in such a condition, that it will come from the filter in a clear state or, if cloudy, capable of being filtered perfectly bright by a second filtration; (*c*) that, once it has been filtered bright, it shall not be liable to become cloudy again or to throw too heavy a deposit. There can be no doubt that, as a general rule, each of these conditions requires that fermentation shall have proceeded to a certain point; and that if the cider is filtered before that point is reached, the result will probably be unsatisfactory. By filtering too early, apart from the difficulties of forcing the liquor through the filter and of obtaining it even in a slightly clear condition, it is frequently found to be impossible afterwards to filter it perfectly bright, a hazy appearance remaining. Possibly the mucilaginous and pectic substances present in the fresh juice may be responsible, fermentation not

having proceeded far enough at the time of filtration to complete the series of changes which they undergo. In this connection it is to be noted that sharp ciders appear to be more easily dealt with by filtration than ciders made from sweet or bitter-sweet apples.

The Improvement of Low Quality Ciders.—A considerable proportion of the fruit used for vintage purposes each season is undoubtedly of very poor quality; and the resulting cider is correspondingly unsatisfactory. Makers have also regularly to deal with a certain amount of rough cider, which results from the residues after racking and various other odds and ends. In many instances ciders which remain unsold in the season after making, deteriorate considerably with age. Consequently, any method by which these low-grade ciders might be improved in quality, or rendered more marketable, deserves attention and calls for investigation.

Recently, a statement was made at the Institute by a visitor to the effect that ciders which were badly acetified and practically undrinkable were greatly improved by being poured over the discarded pomace of a freshly pressed cheese. Evidently they extracted a certain amount of the juice left in the pomace after pressing. There is always some juice so remaining, however effective and prolonged the pressure may have been. The amount is generally equivalent to 60—70 per cent. of the total weight of the pressed pomace and, unless small cider is made, this juice is to all intents and purposes wasted.

The idea that this waste juice might in a similar way prove useful in the amelioration of ciders of low quality led to a few experiments upon the subject last season, and these have been succeeded by more extensive researches during the current season. In the tests last season, the ciders dealt with were those made from mixed residues of various ciders after racking. Both in flavour and general character they were of poor quality, and were also of very low specific gravity. After the pomace from freshly milled fruit had been twice pressed, and would then in the ordinary course of events have been discarded, it was instead roughly broken up and placed in a large wooden vat. The cider to be experimented upon was then pumped on to it, and both liquor and pomace were thoroughly mixed until the whole mass resembled fresh pomace as it comes direct from the mill. It was allowed to stand and soak for about eighteen hours and was then built up into a cheese and placed under the press. The liquor thus extracted was found to possess an entirely different character from that of the original cider. The specific

gravity was much higher and, therefore also, the percentages of solid matter and sugar. The flavour was profoundly modified, possessing a taste of fresh juice and having lost to a considerable extent its previous raw and harsh character. The re-soaked cider was allowed to stand for several days in a cask, in order to allow mucilaginous and other deposits to be thrown down. It was then filtered perfectly bright and placed in store casks. Afterwards there was little variation in its behaviour from that of ordinary freshly filtered cider. By this treatment its value may be said to have been raised at least 2d. per gallon.

It is clear that what actually takes place in the process is that the added cider is thoroughly absorbed by the pomace and thus becomes mixed with the 60 per cent. or so of fresh juice which it already contains. The expressed cider, therefore, consists of a mixture of the two, and their relative proportions are determined by the proportion of old cider added to a definite weight of pomace. In other words, the process simply consists in extracting the non-expressed juice by means of old cider, and although the finally pressed pomace after this treatment still contains about the same percentage of non-expressed liquid, this is no longer fresh juice, but largely old cider. Since the original unextracted juice had practically the same composition as that which was expressed as pure juice during the first pressings of the pomace, it is obvious that the composition of the liquor after re-soaking depends upon the amount of cider added. Thus the average results show that when the proportions used are one gallon of cider to 10 lbs. of pomace, the extracted cider shows a rise of 10–15 points in specific gravity, which is equivalent to a gain of 3—4 per cent. of sugar. The addition of lesser quantities of cider makes the rise in specific gravity and the percentage gain of sugar appreciably higher. An extreme case may be quoted in which ten gallons of old cider, with a specific gravity of 1.004 were added to about 200 lbs. of pomace and the specific gravity of the resulting extract was 1044, which indicates an actual gain of at least 9 per cent. of sugar. These figures give some idea of the amount of valuable matter which is practically wasted by the cider maker, who discards his pomace after a second pressing.

An important point has been observed in all these experiments. The amount of re-soaked cider which is extracted is invariably greater than that which is added. There is thus a direct gain of liquor in addition to the improvement in quality ; and this amount in itself far more than pays for the slight extra expense and trouble of the re-soaking.

The results of these experiments have already shown the great possibilities and value of the method above mentioned. The work now in progress is more particularly concerned with questions of detail, such as the most suitable proportions of cider and pomace and the best time for filtration. A fuller account of these will be published later.

THE CHARACTERS OF SINGLE VARIETY CIDERS MADE IN 1906-7.

During the season 1906-7 ciders were made from single varieties of apples as in previous years. The average quality of these ciders was decidedly superior to that of previous seasons and many of them were quite as palatable as high-class blends. The reason was probably two-fold. In the first place many of the varieties were not extreme as regards chemical composition, the proportions of malic acid or tannin not being large enough to make them excessively sharp or bitter. Secondly, the ciders as a whole were filtered earlier than has been customary hitherto with the result that, in many cases where the proportion of malic acid or tannin was inclined to be in excess, sufficient sweetness was retained to tone down what would otherwise have been disproportionate acidity or bitterness. Another result of the early filtration, followed as it was by early bottling, will be noted in the somewhat large drops in specific gravity in the bottled samples. The details of the individual ciders were as follows :—

SHARP VARIETIES—(including those containing normally at least .45 per cent. of Malic Acid.)

Backwell Red (Somerset).—Analysis of fresh juice, October 30th, 1906 : Specific gravity 1.049, solids 11.80 per cent., total sugar 10.68 per cent., malic acid .56 per cent., tannin .050 per cent., extractives .510 per cent. Filtered December 17th, 1906 : Specific gravity 1.034. Specific gravity in bottle, April 14th, 1908 : 1.018. A light, moderately sweet and brisk cider with a very pleasant aroma ; flavour good, but rather thin and lacking in body. Considerably superior to the average cider made from early fruit. Is fair unblended, but more useful blended with a variety of the Sweet Alford type, or a mild flavoured bitter-sweet.

Cap of Liberty (Somerset).—Analysis of fresh juice, November 8th, 1906 : Specific gravity 1.063, solids 15.18 per cent., total sugar 13.82 per cent., malic acid .93 per cent., tannin .300 per cent., extractives .130 per cent. Filtered December 17th, 1906 : Specific gravity 1.034. Specific gravity in bottle, April 14th, 1908 : 1.020. A rather sweet sharp cider, full bodied and with a good aroma ; flavour pleasant and fruity. Too sharp unblended, but of first-rate quality for blending with bitter-sweets and sweets.

Cowarne Red (Hereford).—Analysis of fresh juice, November 22nd, 1906: Specific gravity 1.054, solids 13.46 per cent., total sugar 12.05 per cent., malic acid .65 per cent., tannin .230 per cent., extractives .530 per cent. Filtered December 24th, 1906: Specific gravity 1.030. Specific gravity in bottle, April 14th, 1908: 1.017. A moderately sweet, medium sharp, full-bodied cider; flavour peculiar and characteristic, but not particularly pleasant. Best adapted for blending, giving a distinct character to the blend.

Frederick (Monmouth).—Analysis of fresh juice, November 15th, 1906: Specific gravity 1.055, solids 12.88 per cent., total sugar 11.46 per cent., malic acid .96 per cent, tannin .048 per cent., extractives .412 per cent. Filtered January 7th, 1907: Specific gravity 1.032. Specific gravity in bottle, April 14th, 1908: 1.018. A medium sweet, full-bodied, sharp cider; flavour pleasant and fruity and a nice aroma. A very useful sharp cider for blending.

Kingston Black (Long Ashton, Somerset).—Analysis of fresh juice, November 16th, 1906: Specific gravity 1.061, solids 14.92 per cent., total sugar 13.43 per cent., malic acid .64 per cent., tannin .204 per cent., extractives .646 per cent. Filtered December 25th, 1906: Specific gravity 1.041. Specific gravity in bottle, April 14th, 1908: 1.032. A good, sweet, medium sharp cider; flavour very pleasant and fruity; aroma excellent. An exceedingly good cider alone, although a trifle sharp for many palates; also admirably adapted for blending.

Kingston Black (Martock, Somerset).—Analysis of fresh juice, November 16th, 1906: Specific gravity 1.070, solids 17.28 per cent., total sugar 14.46 per cent., malic acid .68 per cent., tannin .202 per cent., extractives 1.938 per cent. Filtered December 27th, 1906: Specific gravity 1.043. Specific gravity in bottle, April 14th, 1908: 1.029. A very good sweet, full-bodied, medium sharp cider; flavour very pleasant and fruity and aroma good; acidity not quite so noticeable as in the Long Ashton Kingston Black cider. Very good alone or blended.

Kingston Black (Gloucester).—Analysis of fresh juice, November 16th, 1906: Specific gravity 1.073, solids 17.98 per cent., total sugar 15.41 per cent., malic acid .71 per cent., tannin .208 per cent., extractives 1.652 per cent. Filtered December 18th, 1906: Specific gravity 1.033. A sweet, medium sharp cider; flavour very fair and full-bodied; aroma very fair. A useful cider alone or blended, but not so clean as the Long Ashton and Martock Kingston Black ciders. The fruit was gathered exceptionally early, and was stored in the apple loft some time before being made up.

Lady's Finger (Somerset).—Analysis of fresh juice, October 25th, 1906: Specific gravity 1.059, solids 14.36 per cent., total sugar 13.24 per cent., malic acid .59 per cent., tannin .126 per cent., extractives .404 per cent. Filtered November 19th, 1906: Specific gravity 1.023. Specific gravity in bottle, April 14th, 1908: 1.013. A light, medium sweet, brisk cider of pleasant but peculiar flavour and aroma. Serviceable alone or blended, although not of first rate quality.

Lambrook Pippin (Somerset).—Analysis of fresh juice, December 30th, 1906: Specific gravity 1.057, solids 13.28 per cent., total sugar 12.73 per cent., malic acid .58 per cent., tannin .242 per cent., A useful, slowly fermenting medium sharp cider with very fair aroma.

Langworthy (Devon).—Analysis of fresh juice, November 16th, 1906: Specific gravity 1.051, solids 12.54 per cent., total sugar 10.80 per cent., malic acid .47 per cent., tannin .124 per cent., extractives 1.146 per cent. Filtered January 2nd, 1907: Specific gravity 1.038. Specific gravity in bottle April 14th, 1908: 1.030. A very pleasant, light, sweet, brisk cider; flavour good and characteristic; aroma good. A very useful cider for blending or use alone, its only deficiency being a lack of body and general strength.

Skyrme's Kernel (Hereford).—Analysis of fresh juice, December 18th, 1906: Specific gravity 1.049, solids 11.72 per cent., total sugar 10.88 per cent., malic acid .55 per cent., tannin .172 per cent., extractives .118 per cent. Filtered January 17th, 1907: Specific gravity 1.030. Specific gravity in bottle, April 14th, 1908: 1.018. A useful, light, medium sweet, brisk cider; flavour and aroma good. A serviceable cider for blending, but a trifle too sharp alone.

Tom Putt (Worcester).—Analysis of fresh juice, November 8th, 1906: Specific gravity 1.051, solids 13.18 per cent., total sugar 11.32 per cent., malic acid .62 per cent., tannin .110 per cent., extractives 1.130 per cent. Filtered December 17th, 1906: Specific gravity 1.008. Specific gravity in bottle, April 14th 1908: 1.002. A somewhat thin, dry, sharp cider; flavour and aroma unpleasant. Of very poor quality during first season, both alone and blended. Considerably improved after twelve months in bottle.

SWEET VARIETIES—(including those containing normally less than .45 per cent. Malic Acid and .20 per cent. Tannin.)

Ansell (Gloucester).—Analysis of fresh juice, December 20th, 1906: Specific gravity 1.057, solids 14.12 per cent., total sugar 12.73 per cent., malic acid .43 per cent., tannin .186 per cent., extractives .774 per cent. A dry, slightly brisk cider of fair quality; flavour and aroma fair.

Ashton Brown Jersey (Long Ashton, Somerset).—Analysis of fresh juice, December 18th, 1906: Specific gravity 1.047, solids 11.56 per cent., total sugar 10.42 per cent., malic acid .16 per cent., tannin .168 per cent., extractives .812 per cent. Filtered January 8th, 1907: Specific gravity 1.040. A light, sweet cider; very clean on the palate and of good flavour and aroma. Very useful for use alone or for blending as a neutral, but rather lacking in body.

Cluster Jersey (Somerset).—Analysis of fresh juice, November 28th, 1906: Specific gravity 1.052, solids 12.84 per cent., total sugar 11.60 per cent., malic acid .20 per cent., tannin .196 per cent., extractives .844 per cent. Filtered December 17th, 1906: Specific gravity 1.036. A moderately sweet cider; flavour and aroma very fair. A useful neutral cider, fermenting at a moderate rate.

Davis' Favourite (Somerset).—Analysis of fresh juice, December 12th, 1906: Specific gravity 1.042, solids 10.76 per cent., total sugar 9.60 per cent., malic acid .18 per cent., tannin .188 per cent., extractives .792 per cent. Filtered January 1st, 1907: Specific gravity 1.029. Specific gravity in bottle, April 14th, 1908: 1.019. A medium sweet cider with fairly pleasant flavour and aroma. Useful as a neutral, but lacks character and richness.

Loram's Sweet White (Devon).—Analysis of fresh juice, November 8th, 1906: Specific gravity 1.069, solids 17.28 per cent., total sugar 14.92 per cent. malic acid .27 per cent., tannin .124 per cent., extractives 1.948 per cent. Filtered December 18th, 1906: Specific gravity 1.030. Specific gravity in bottle, April 14th, 1908: 1.016. A medium sweet cider with flavour and aroma fairly pleasant, but inclined to coarseness. Useful as a neutral on account of its high original gravity and consequent alcoholic strength.

Northwood (Devon).—Analysis of fresh juice, November 15th, 1906: Specific gravity 1.060, solids 14.60 per cent., total sugar 13.24 per cent., malic acid 24 per cent., tannin .220 per cent., extractives .900 per cent. Filtered December 16th, 1906: Specific gravity 1.018. Specific gravity in bottle, April 14th, 1908: 1.005. A medium dry cider; aroma and flavour fair, but slightly coarse. Of some value for blending as a neutral and fair alone, but somewhat deficient in quality.

Sweet Alford (Devon).—Analysis of fresh juice, October 30th, 1906: Specific gravity 1.059, solids 15.12 per cent., total sugar 13.43 per cent., malic acid .15 per cent., tannin .134 per cent., extractives 1.406 per cent. Filtered December 29th, 1906: Specific gravity 1.043. Specific gravity in bottle, April 14th, 1908: 1.030. A rich, sweet, full bodied cider of excellent quality; flavour fruity and aroma very good. For blending as a neutral or use alone most useful, although lacking rather in acidity for the latter purpose.

Symes' Sweet (Somerset).—Analysis of fresh juice, November 8th, 1906: Specific gravity 1.052, solids 13.04 per cent., total sugar 11.60 per cent., malic acid .15 per cent., tannin .214 per cent., extractives 1.582 per cent. Filtered December 27th, 1906: Specific gravity 1.031. Specific gravity in bottle, April 14th, 1908: 1.023. A very useful sweet cider of good flavour and aroma. Adapted for blending as a neutral, or pleasant for use alone, although hardly sharp enough for this purpose.

Woodbine (Devon), also known as *Slack-ma-girdle*.—Analysis of fresh juice, November 15th, 1906: Specific gravity 1.062, solids 15.36 per cent., total sugar 13.82 per cent., malic acid .18 per cent., tannin .150 per cent., extractives 1.210 per cent. Filtered December 30th, 1906: Specific gravity 1.027. Specific gravity in bottle, April 14th, 1908: 1.021. A rather sweet full-bodied cider; aroma very fair, flavour good. Useful alone or for blending as a neutral.

BITTER-SWEET VARIETIES—(including those containing normally less than .45 per cent. Malic Acid and more than .20 per cent. Tannin.)

Ashton Bitter White (Somerset).—Analysis of fresh juice, October 18th, 1906: Specific gravity 1.054, solids 13.68 per cent., total sugar 12.20 per cent., malic acid .18 per cent., tannin .420 per cent., extractives .880 per cent. Filtered November 26th, 1906: Specific gravity 1.030. A medium sweet, rather bitter cider, with very fair aroma and flavour, but somewhat thin. Useful for blending.

Ashton Early Red Jersey (Somerset).—Analysis of fresh juice, October 11th, 1906: Specific gravity 1.050, solids 12.64 per cent., total sugar 11.06 per cent. malic acid .16 per cent., tannin .390 per cent., extractives 1.030 per cent. Filtered November 20th, 1906: Specific gravity 1.027. A cider of similar character to the preceding, but a trifle fuller in flavour.

Ashton Russet Jersey (Somerset).—Analysis of fresh juice, November 23rd, 1906: Specific gravity 1.05, solids 15.60 per cent., total sugar 15.16 per cent., malic acid .19 per cent., tannin .400 per cent. Filtered December 17th, 1906: Specific gravity 1.014. A rather dry, bitter cider; aroma fair, flavour moderate and coarse. Suited only for blending, and lacking in quality.

Ashton White (Somerset).—Analysis of fresh juice, October 11th, 1906: Specific gravity 1.052, solids 13.26 per cent., total sugar 12.20 per cent., malic acid .21 per cent., tannin .400 per cent., extractives .450 per cent. Filtered November 19th, 1906: Specific gravity 1.028. Specific gravity in bottle, April 14th, 1906: 1.015. A cider of same character as Ashton Bitter White, but rather softer and less bitter.

Cherry Norman (Hereford).—Analysis of fresh juice, October 30th, 1906: Specific gravity 1.055, solids 13.60 per cent., total sugar 12.20 per cent., malic acid .14 per cent., tannin .352 per cent., extractives .908 per cent. Filtered December 17th, 1906: Specific gravity 1.031. Specific gravity in bottle, April 14th, 1908: 1.016. A rather sweet, mildly bitter cider; aroma and flavour fairly good. Useful alone or for blending, but a little too bitter to be entirely suited for the former purpose.

Chisel Jersey (Somerset).—Analysis of fresh juice, December 31st, 1906: Specific gravity 1.069, solids 16.40 per cent., total sugar 15.31 per cent., malic acid .22 per cent., tannin .610 per cent., extractives .260 per cent. A slowly fermenting cider, full-bodied, and of good flavour and aroma. Too bitter alone, but very useful for blending in moderate quantity.

Counsellors (Gloucester).—Analysis of fresh juice, November 8th, 1906: Specific gravity 1.071, solids 17.30 per cent., total sugar 15.16 per cent., malic acid .17 per cent., tannin .450 per cent., extractives 1.520 per cent. Filtered December 17th, 1906: Specific gravity: 1.008. Specific gravity in bottle, April 14th, 1908: 1.004. A harsh, dry, bitter-sweet cider; flavour and aroma poor. Fermented very rapidly, and of little value either alone or for blending, apart from its high alcoholic strength.

Dabinet (Somerset).—Analysis of fresh juice, December 20th, 1906: Specific gravity 1.052, solids 12.94 per cent., total sugar 11.81 per cent., malic acid .19 per cent., tannin .238 per cent., extractives .702 per cent. A useful medium bitter-sweet cider, fermenting at a moderate rate. Flavour and aroma very fair.

Horners (Somerset).—Analysis of fresh juice, November 8th, 1906: Specific gravity 1.053, solids 13.40 per cent., total sugar 11.89 per cent., malic acid .15 per cent., tannin .240 per cent., extractives 1.120 per cent. Filtered December 24th, 1906: Specific gravity 1.037. Specific gravity in bottle April 14th, 1908: 1.023. A rather sweet, very agreeable, mildly bitter-sweet cider; flavour and aroma good. Pleasant alone, although lacking acidity, and useful for blending.

Major (Devon).—Analysis of fresh juice, October 30th, 1906: Specific gravity 1.060, solids 14.66 per cent., total sugar 13.62 per cent., malic acid .19 per cent., tannin .400 per cent., extractives .450 per cent. Filtered December 29th, 1906: Specific gravity 1.030. Specific gravity in bottle, April 14th, 1908: 1.021. A sweet, rich, full-bodied bitter cider: flavour and aroma very good. Very useful for blending, but rather too bitter alone.

Master's Jersey (Somerset).—Analysis of fresh juice, November 30th, 1906: Specific gravity 1.062, solids 15.44 per cent., total sugar 13.82 per cent., malic acid .19 per cent., tannin .310 per cent., extractives 1.120 per cent. Filtered December 24th, 1906: Specific gravity 1.042. Specific gravity in bottle, April 14th, 1908: 1.027. A sweet, rich, moderately bitter cider; aroma pleasant and flavour good. Very useful for blending, and, although rather bitter, of very fair quality for use alone.

Prince Albert (Gloucester).—Analysis of fresh juice, November 28th, 1906: Specific gravity 1.070, solids 17.26 per cent., total sugar 15.16 per cent., malic acid .33 per cent., tannin .600 per cent., extractives 1.170 per cent. Filtered December 27th, 1906: Specific gravity 1.039. Specific gravity in bottle, April 14th, 1908: 1.026. A sweet, full-flavoured bitter cider; aroma fair, flavour characteristic and very fair. Very useful for blending as a bitter-sweet, especially on account of its high original gravity.

Pytheres (Monmouth).—Analysis of fresh juice, November 15th, 1906: Specific gravity 1.051, solids 12.98 per cent., total sugar 11.19 per cent., malic acid .15 per cent., tannin .196 per cent., extractives 1.444 per cent. Filtered December 10th, 1906: Specific gravity 1.027. Specific gravity in bottle, April 14th, 1908: 1.016. A medium sweet, rather light cider with a trace of bitterness; flavour and aroma very fair. Useful in blending, and pleasant for use alone. Has less bitterness than is usual with this variety.

Royal Wilding (Gloucester).—Analysis of fresh juice, October 25th, 1906: Specific gravity 1.066, solids 16.14 per cent., total sugar 13.82 per cent., malic acid .34 per cent., tannin .310 per cent., extractives 1.670 per cent. A rough, rapidly fermenting, bitter, dry cider. Its main value for blending is its strength.

Royal Wilding (Quedgeley, Gloucester).—Analysis of fresh juice, November 30th, 1906: Specific gravity 1.057, solids 13.80 per cent., total sugar 11.60 per cent., malic acid .26 per cent., tannin .156 per cent., extractives 1.784 per cent. A cider of similar character to the preceding, but not so strong.

Strawberry Norman (Hereford).—Analysis of fresh juice, November 22nd, 1906: Specific gravity 1.057, solids 13.98 per cent., total sugar 12.70 per cent., malic acid .33 per cent., tannin .430 per cent., extractives .520 per cent. Filtered December 24th, 1906: Specific gravity 1.032. Specific gravity in bottle April 14th, 1908: 1.022. A sweet, full, fruity, somewhat bitter cider; flavour and aroma good. Very useful for blending, and not unpalatable, although rather bitter, alone.

White Norman (Hereford).—Analysis of fresh juice, October 30th, 1906: Specific gravity 1.054, solids 13.36 per cent., total sugar 12.20 per cent., malic acid .14 per cent., tannin .300 per cent., extractives .720 per cent. Filtered December 17th, 1906: Specific gravity 1.022. Specific gravity in bottle, April 14th, 1908: 1.012. A moderately sweet cider, rather inclined to bitterness; flavour and aroma very fair. Useful for blending.

Yarlington Mill (Somerset).—Analysis of fresh juice, November 30th, 1906: Specific gravity 1.053, solids 12.96 per cent., total sugar 11.75 per cent., malic acid .23 per cent., tannin .400 per cent., extractives .580 per cent. A typical medium bitter-sweet cider of fair quality, fermenting at a moderate rate.

PERRY.

Barland (Worcester).—Analysis of fresh juice, October 11th, 1906: Specific gravity, 1.054, solids 13.78, per cent., total sugar 11.32 per cent., malic acid .62 per cent., tannin .119 per cent., extractives 1.641 per cent. A sharp, rather thin perry; flavour and aroma moderate. Lacks alcoholic strength and best blended with a more stringent variety.

Butt (Gloucester).—Analysis of fresh juice, November 29th, 1906; Specific gravity 1.053, solids 12.76 per cent., total sugar, 11.75 per cent., malic acid .66 per cent., tannin, .270 per cent., extractives, .080 per cent. Filtered December 31st, 1906: Specific gravity 1.043. Specific gravity in bottle, April 14th, 1908: 1.028. An astringent, and medium sharp, full-flavoured perry; flavour and aroma very fair, but too marked in character: throws a heavy crust in bottle. Too astringent alone, but useful for blending. After twelve months in bottle loses some of its astringency and is then of excellent quality.

Oldfield (Gloucester). Analysis of fresh juice, November 22nd, 1906: Specific gravity 1.068, solids 16.88 per cent., total sugar 14.92 per cent., malic acid .80 per cent., tannin .128 per cent., extractives 1.032 per cent. A rather sharp full-bodied sweet perry; flavour and aroma delicate and pleasant. An excellent perry unblended, although inclined to be sharp.

The characters of Single Variety Ciders made on a small scale in the laboratory will be found in Appendix A.

CIDER SICKNESS.

In the last Annual Report a short account of the characteristic features of cider sickness and of the results obtained in the experimental work on that subject was given. It was proved that the disorder was due to the action of a special organism or organisms; that it could be induced in a sound cider by infection with a "sick" sample, certain types being more readily affected than others; and that a high temperature favoured its development.

During the summer of 1907 several examples of cider sickness were met with, and additional information on the subject resulted, while further results of the experimental work have indicated the means by which it appears extremely probable that the trouble may be entirely avoided.

An interesting and suggestive side-light on the characteristic flavour developed in the course of "sickness" occurred in connection with the analysis of a special variety of cider apple grown in Devon. It was noticed that the fresh juice from this sample of fruit possessed an odour, resembling that of sick cider. The juice was, therefore, tasted, and it was found to have a flavour indistinguishable from that of "sick" cider. Since the juice had only just been expressed, when the aroma of "sickness" was noticed, it did not seem at all likely that any change could have taken place outside the fruit. An examination of other specimens of the fruit of that variety showed that the apples themselves possessed the same taste and aroma. To all outward appearance the fruit, although on the over-ripe side, was nevertheless perfectly sound, and a minute examination failed to show any sign of disease or bacterial infection. Every specimen of that variety possessed the same characters of taste and smell to some extent, although different specimens showed it to a variable degree. It is of some importance to note that samples of the same variety obtained from the same source this season, did not possess the "sick" characters. It certainly appears from this case that the formation of the substance to which the "sick" taste is due is brought about by chemical changes in some natural constituent of the apple, and that in the fruit itself the change may be brought about without the agency of micro-organisms, whatever be the case with regard to the corresponding change in the ciders.

It was mentioned in the previous account of cider sickness that the development of the disorder was accompanied either by turbidity of the liquor, or by the production of a copious deposit. At first it was thought that the deposit or the material responsible for the turbidity consisted mainly of yeast cells and bacteria, since the disorder was accompanied by the activity of these organisms. Examined microscopically, it appeared to consist mainly of coccus-like bacteria cells with a few yeast cells intermingled. Further examination, however, has shown that the small coccus-like bodies are really minute particles of some substance, which has been thrown out of solution. They appear to be droplets of an oily nature, and usually occur in small adherent groups. They are soluble in hot water and in alcohol. Their exact chemical nature has not

yet been determined. While the formation of this substance has been observed in every case of "sickness" met with at the Institute last season, and is apparently a regular feature characteristic of the disorder, there is reason to believe that it may occur unaccompanied by the other manifestations of sickness, more particularly the characteristic odour and the violent "secondary" fermentation. For example, in certain laboratory experiments on sterilised apple juice and ciders the production of an apparently similar deposit has been noted, both at times in the sterilised juice or cider and frequently in these liquids after infection with certain yeasts or bacteria. Neither the "sick" aroma nor the rapid "secondary" fermentation occurred in these cases. It has not yet been ascertained if a similar change can take place in ordinary unsterilised cider without being accompanied by the features of "sickness." Without entering into a discussion as to the nature of these changes and their bearing upon the problem of sickness, it may at any rate be surmised that "sickness" is not the outcome of a simple change or fermentation, but probably represents a complex series of changes.

Some important details as to the liability of various ciders to "sickness" have been obtained by fermenting the fresh juices at a temperature of 84° F. It has been found that in some cases the daily drop in specific gravity is regular and fairly constant, continuing so until a gravity of 1.010 or less is reached. In other cases the daily fall in gravity is regular for a short period only and then, for an interval of two or three days or even longer, comes practically to a standstill, suddenly afterwards starting again at a more rapid rate. The latter type represents the class liable to "sickness" and the renewal of an active fall in gravity marks the point at which the first manifestations of "sickness" become apparent. As a general rule the original daily drop in gravity is low in these cases as compared with the average daily drop in ciders of the former type; and since the comparative rates of fall in gravity at 84° F., the temperature at which the experiments were conducted, corresponds with the comparative rates of fall in the same ciders in bulk in the cider house, although, of course, since the temperature is much lower in the latter case usually between 40° F. and 50° F.—the actual rates of fall are much slower, there is thus confirmation of previous experience that it is the slowly fermenting ciders which are liable to sickness. The ciders which are liable to turn "sick" during the spring or summer after making may, therefore, be ascertained during the previous winter,

while they are undergoing the normal primary fermentation by noting their rates of fermentation.

The following statistics showing the daily drop in gravity of Horners' and Northwood ciders, kept at 84° F. are typical illustrations of the behaviour of the two types :—

	Northwood.	Horners.
Original gravity of the fresh juice	1.060	1.053
Gravity after 1 day at 84° F.	1.057	1.051
„ 2 days „	1.049	1.048
„ 3 „ „	1.041	1.047
„ 4 „ „	1.030	1.046
„ 5 „ „	1.023	1.044
„ 6 „ „	1.015	1.041
„ 7 „ „	1.011	1.039
„ 8 „ „	1.006	1.037
„ 9 „ „	Records not	1.037
„ 10 „ „	further taken.	1.035
„ 11 „ „		1.028
„ 12 „ „		1.024
„ 13 „ „		1.015
„ 14 „ „		1.008
„ 15 „ „		1.005

Comparing these two examples, Northwood cider, with an average daily drop in gravity of $6\frac{3}{4}$ points, fermented normally and regularly to dryness, while Horners' cider showed an average daily fall of 1 7-9ths points up to the time when gravity had remained constant at 1.037 for two successive days. The following day sickness first became apparent, and the succeeding figures are of interest mainly as showing the rapid character of the " secondary " fermentation accompanying " sickness." The same ciders fermented in the cider house in bulk at the following rates :—

	Northwood.	Horners.
Original gravity of fresh juice	1.060	1.053
Gravity after 1 week	1.059	1.053
„ 2 weeks	1.050	1.049
„ 3 „	1.034	1.046
„ 4 „	1.034	1.042
„ 5 „	1.018	1.040
„ 6 „	The cider was	1.038
„ 7 „	filtered at this stage.	1.037 The cider was filtered at this stage.

There was, therefore, a general correspondence in the comparative rates of fermentation at both temperatures, allowing for the variations in temperature which occurred in the cider house. Thus in the case of Northwood cider there was no appreciable fall in gravity

between the 3rd and 4th week owing to a spell of frosty weather. Horners' cider being made earlier escaped this for the corresponding period.

Another feature of importance in connection with the disorder has been noticed. One of the ciders made at the Institute last season, composed of a blend of Lambrook Pippins and Chisel Jerseys was characterised by a very slow rate of fermentation. Samples of this cider were bottled up at intervals from February onwards. The samples which were bottled before the middle of April remained perfectly sound in bottle and produced comparatively little deposit during the course of the summer. Those bottled later than that date without exception turned " sick," " sickness " appearing the more quickly after bottling the later the date of bottling. Similar results were obtained with Harry Masters' cider and Oldfield perry. It was noteworthy also that the ciders and perry in cask remained perfectly sound during the summer so long as they were undisturbed ; but as soon as the casks were tapped, " sickness " invariably made its appearance within a short space of time. It seems, therefore, that after such ciders have reached a certain age—or, in other words, after normal alcoholic fermentation has practically come to a standstill—the least disturbance involving access of air, suffices to start the disorder into activity. Although it has not yet been definitely proved, it is probable that the stimulus is due to the action of the oxygen in the air. The same ciders, if bottled up early enough, may be shaken vigorously and otherwise disturbed in bottle without showing the slightest symptom of " sickness," so evidently the required stimulus is not merely a mechanical one. Clearly, if ciders of this type are being dealt with, the surest safeguard against " sickness " is to bottle early. Owing to their character of slow fermentation they are not likely to throw a heavy deposit or to develop too much gas in bottle as a result of the early bottling. If they must be treated as draught ciders, it is advisable to consume them as early as possible.

The most promising way of avoiding sickness, as indicated by the results of the experimental work, seems to be to blend fruit or their juice or cider—possessing the character of excessively slow fermentation with sorts which ferment more rapidly. The rate of fermentation of the blend is thus rendered sufficiently rapid to keep off any disposition to sickness. At the same time by filtration it is quite possible to preserve a sufficiency of sweetness in the fermented cider.

THE RELATIONS BETWEEN THE QUALITY OF THE FRUIT AND THE METHODS OF TREATMENT OF THE TREES.

Little is known at present as to the possible influence of the various methods of treatment of trees of vintage fruit during the course of their growth on the nature and quality of the cider made therefrom. In the young orchard at the Institute trees of several well known vintage varieties were planted four years ago, there being five or ten trees of each kind. A scheme of experiments on these has been in progress since the time of planting, and has been so arranged that eventually each tree of a variety will have been subjected to a different method of treatment. Up to the present time the main differences in treatment have consisted in the removal of the turf around the base of the tree to a varying extent; in some cases, however, in allowing the grass to grow right up to the base of tree, and in the methods of pruning adopted. There will, therefore, in course of time, when the trees are large enough to bear sufficient crops of fruit to allow of small scale lots of cider being made, be information forthcoming as to the influence, if any, of these methods of treatment on the quality of the cider. Up to the present time, of course, the yield has been too small to be of any practical use ; but during 1907 some of the trees bore sufficient fruit for analytical purposes. The results are given in Appendix B, and it is intended to publish corresponding details year by year, so that the history of the investigations may be followed by those interested step by step.

It must be pointed out that too much reliance ought not to be placed upon the first few seasons' results, and definite conclusions drawn from them would be liable to be premature, since the total amount of fruit from each tree will be small and the results therefore more affected proportionately by external disturbing influences. They are, therefore, given on that understanding, and will very possibly be found to differ considerably in character in succeeding seasons. They are, however, interesting, and may be found valuable for comparison with later statistics.

ANALYSES OF APPLES AND PEARS, 1907-8.

Appendix C gives the results of the analyses of apples and pears made at the Institute during the season 1907-1908. It will be noticed that the details given differ somewhat in character from those included in previous Reports. Experience has shown that the

essential data are the specific gravity of the juice and the percentages of malic acid and tannin. Hitherto it has been customary to include also the percentages of solids, sugar and extractives. If the specific gravity is known, then for practical purposes the percentages of solids and sugar are not required, since the approximate amounts can be ascertained from the specific gravity, tables which give those statistics having been previously published by various authorities. With regard to extractives it is felt that the methods of analysis employed for the determination of the percentages of total solid matter, sugar, and tannin, are not sufficiently delicate to allow of much value being attached to the result obtained for the extractives, since it is arrived at by deduction of the sugar, malic acid, and tannin results from the result for total solids, and therefore at best is but a rough approximation, while the percentage is generally so small that an approximate result of this character cannot be depended upon.

The plan adopted then this season is to give the results for the specific gravity, malic acid and tannin, since these indicate respectively the approximate degree of solid matter, acidity, and astringency of the juice ; and also to add the approximate percentage of sugar, the figures given being based on published tables and previous experience. Instead, however, of merely quoting the approximation which corresponds to the ascertained specific gravity it is thought that the result will be of more general and practical use, if expressed so as to show the limits between which the percentage of sugar would probably vary according to the state of ripeness at which the fruit was milled. It is well known that the amount of sugar varies greatly during the period of ripening of the fruit. The limits given, however, are only intended to apply to that period during which the fruit might fairly be considered fit for grinding.

THE FERMENTATION OF CIDERS WITH SELECTED YEASTS.

For some years this question has aroused considerable interest in the cider industry. In France and Germany many makers regularly conduct their fermentations with special yeasts and the practice appears to have become regularly established as a result of the success of extensive trials. In this country the matter is not in such an advanced stage and few makers have had much experience of the method. Foreign experience is in this case of limited value only, since the type of cider produced and the standard aimed at differ considerably in the respective cases, while the class of

fruit and, therefore, the nature of the raw juice dealt with are not the same. Experimental work on the subject was started by Mr. F. J. Lloyd at Butleigh some years ago, and has been carried on extensively at the Institute each season since 1904. The nature of the work has been referred to briefly from year to year in the Annual Reports of the Institute, and a mass of information has been obtained as to the various kinds of cider yeasts, their characters, the parts played by them in cider fermentations and their influence on the flavour of cider. Since so much of this material has a purely indirect bearing upon cider-making, and, being highly technical in character, is of little interest to the cider-maker, no attempt will be made in this Article to deal with the various sides of the work in detail. It is intended rather to summarise the results and put briefly before the maker the advantages which may be gained by the use of selected yeasts.

Considerable misconception exists regarding the benefits which may be expected from fermentation by suitable yeasts. Some makers apparently think that, once a yeast of first-rate quality can be found, its employment will do away with all further fermentation troubles and will lead invariably to the production of a cider of the highest quality and of uniform flavour, no matter what the original quality of the juice. It is, therefore, advisable to state at the outset that expectations of that kind will certainly lead to disappointment. The quality of the juice must always be taken into consideration; for no organism can make up for original deficiencies of the raw material. The most perfect ferment could not achieve more than to do the best, which circumstances allow. To quote a somewhat parallel case, if seed of the best strain is sown, the quality of the crops depends very largely upon the nature of the soil. The crop is not always of the highest class; and it does not follow that, because good seed is used in poor soil, better crops are obtained than by using inferior seed in good soil. Developing the parallel further, a particular variety of seed is not necessarily suited to every class of soil, because it gives excellent results with most soils. Another variety, whose average results are decidedly inferior, may for a particular soil give much better results than the other. Ciders also, like soils, show corresponding differences of character; and a ferment which gives good results with several types of juice may not prove as good for certain juices as another, which is usually inferior to it.

It is, then, necessary to take into consideration not only the character of the yeast but also the qualities of the juice, when experiments with selected yeasts are conducted. In many trials

the ferments have been condemned as bad or unsatisfactory, when in reality it was the juice which was at fault. For example, in certain cases the cider ferments with extreme rapidity; and it is customary among many makers to attribute this to the presence of too energetic and entirely undesirable ferments. It is, however, nothing of the kind in the average case. The cause of the rapidity of the fermentation lies in the character of the juice, which, owing to the large amount of nitrogenous yeast food contained in it, is of a nature to encourage very active growth and multiplication of the yeasts present, and consequently to undergo an excessively rapid and, so to speak, coarse fermentation. If the same yeasts are transferred to a juice of opposite character—that is to say, a juice containing a small amount of nitrogenous yeast food—they no longer produce a rapid fermentation. Their nutrition and rate of multiplication suffer because of the deficiency of nitrogenous matter; and, therefore, they are unable to ferment at a rapid rate. It is clearly proved, thus, that it is incorrect to attribute the rate of fermentation in ordinary cider fermentations to the kinds of yeast present. It is the nature of the juice which is mainly responsible for the rate.

In making this statement it must be understood that reference is made only to juices which have not been sterilised before fermentation. If juices are first sterilised, and then fermented with a selected yeast, the rate of fermentation does not depend so largely on the character of the juice. This factor is still important, and plays a great part in determining the rate of fermentation, but the fermentative powers of the kind of yeast used is equally important in such cases. The rate of fermentation, then, is fast or slow, not merely according to the richness of the juice in nitrogenous yeast-food or the reverse, but also according to the power of the yeast to set up a rapid or slow fermentation, although it must be borne in mind that even a rapidly fermenting yeast cannot set up a rapid fermentation in a juice deficient in nitrogenous yeast-food.

But since the sterilisation of the juice prior to fermentation is in practice not easy and generally unsatisfactory on account of the flavour being impaired, this side of the question will not be further considered here. The fermentations with selected yeasts to be referred to are what are known as "dominant" fermentations. In these the juice used is not sterilised. It contains, therefore, the yeasts naturally occurring in it in a living state. In order to get the desired effect with the added selected yeast, a quantity of the latter sufficient to overcome and crowd out the naturally occurring yeasts is used.

It may be asked why slowly fermenting selected yeasts could not be used for "dominant" fermentations, and thus a comparatively slow rate of fermentation obtained, even in juices rich in nitrogenous yeast-food. This has been attempted, but the results so far invariably show that the rate of fermentation is practically as quick when they are used, as when rapidly fermenting kinds are selected. The reason for this appears to be that the juice always contains naturally some rapidly fermenting kinds, and, if the less active sorts are added, their influence is not sufficient to keep in check the growth of the former, which eventually, therefore, gain the upper hand and carry on the fermentation at the rate natural to the juice.

It seems to be an important point, therefore, in "dominant" fermentation work to use a selected yeast which is powerful enough to keep under the yeasts which occur naturally in the juice, so that there may be no doubt that the results of the fermentation are due to the former and not to the latter. When such are used, the results obtained up to the present time show that, when the same kind of juice is utilised for a series of tests with different yeasts, the general rate of fermentation, as indicated above, does not show much difference in the individual ciders, while there is also the same general character of flavour in all. But while there is, perhaps, sufficient resemblance in flavour to make it plain that the same juice must have been used in each case, there are less conspicuous differences of flavour between the various ciders, which are none the less highly important, and for which not the juice, but the kind of yeast, is responsible. For example, supposing Kingston Black juice to have been used throughout, each cider would possess the particular Kingston Black features of flavour, for which, of course, the kind of apple or juice used must be accounted responsible. But just as one finds constantly in practice that Kingston Black ciders, while possessing much the same flavour up to a certain point, nevertheless differ among themselves in particular points of flavour —so much so sometimes that one cider may be very pleasant and another quite unpalatable—so with ciders made from the same juice fermented with different yeasts these small indescribable distinctions in flavour, which can make so marked a difference in the palatableness of the liquor, occur.

These slight differences in flavour may take the form of small variations in bitterness or acidity, in softness or roughness on the palate, and similar characteristics. They represent the effect of the kind of yeast used in the respective cases.

On the other hand if the same yeasts are used with another kind

of juice, a great difference both in rate of fermentation and general character of flavour as compared with the preceding set of ciders may be observed. For this the juice must be held responsible. If, for example, two ciders fermented with the same kind of yeast are compared, the most striking feature is the difference in the general character of flavour, which is as a rule so pronounced that it is impossible to detect that the same ferment has been used in both instances. Careful comparison of the less striking points of flavour will show, however, that usually the characters which are attributed to the effect of the yeast in the one case may be detected in the other also, although they are overshadowed by the more pronounced differences in flavour, caused by the kind of juice used. Thus, if a certain yeast has caused in the one cider a rough, somewhat harsh flavour as compared with the soft character given to the same cider by another yeast, the same two yeasts used with the other cider will also be found to have produced as a rule similar harshness and softness respectively.

It has been suggested that if the yeasts found in a particular variety of apple, or in the cider made from that sort, are used as special ferments, they are capable in some degree of imparting to any kind of juice to which they are added the flavour of the kind of apple with which they are found associated. Thus far the work at the Institute does not in the slightest degree support that idea, while no satisfactory evidence has been obtained to prove that certain kinds of yeasts are habitually found in association with particular sorts of apples.

The real value of using selected yeasts for cider fermentations appears to be (1) that the fermentation is of a regular standard nature, so that there is not a liability to loss of quality of flavour, as occasionally happens owing to the fermentation being conducted by inferior yeasts, such as sometimes occur abundantly in fresh juice; and (2) that the characters of flavour due to the action of the yeast can be generally developed in any cider for which that particular yeast is used.

It is hoped that next season small quantities of selected yeasts which have given good results in the earlier trials will be available for the use of Members and Associates. Anyone desiring to try them should apply to the Director before the end of September next. The methods of using them will be furnished to all applicants.

A NEW METHOD OF FRUIT BOTTLING.

There are several methods of fruit bottling suitable for domestic use, which are more or less satisfactory, but all possess drawbacks of some kind. Speaking generally, they rely upon the sterilisation of the fruit by heat for their efficacy. In most of the methods commonly used it is not difficult to effect a sufficient sterilisation satisfactorily, but it is not so easy to keep the fruit in a sterile condition; and it is in this way that most methods are unreliable. It is essential, if reliability is to be ensured, that after the fruit in bottle has once been sterilised and sealed down there shall be no possibility of moulds, yeasts, or bacteria gaining access to the contents. If they do gain an entry, the fruit is spoilt. But in all methods where corks, bladders, parchment or fat are used for sealing the bottles there is always considerable risk of this occurring, since the bottle is not hermetically sealed, and hence there is no certainty of regular success with such methods. A few years ago a method by which the bottles could be hermetically sealed was introduced, and this gives consistently satisfactory results, provided that the original sterilisation is thoroughly carried out. This method, which is now fairly well-known, is quite simple in practice, and no elaborate apparatus is necessary; but it involves the use of a specially made bottle with a cap and rubber ring to fit, so that, although the bottles can be used time after time, the original cost of the bottles and accessories prevents many people making use of it. Several types of these bottles are now on the market. They vary somewhat as to the means by which the hermetical sealing is accomplished, but the general method of using them is substantially the same. The details are as follows:—The bottle is filled to the neck with fruit and just sufficient water is added to cover the top of the fruit; the lid is then placed on the bottle, care being taken that the rubber ring, or corresponding article required to secure an air-tight junction between the lid and the bottle, is in perfect condition; the bottle is then placed in a vessel containing cold water enough to reach the shoulder of the bottle, and the temperature of the water is gradually raised to 150° F.; it is allowed to remain stationary at that point for 20 minutes to half an hour according to the nature of the fruit used, after which the bottle is removed and allowed to cool; if the lid is held in place by a spring clip no attention is necessary after affixing it to the bottle, but if it is of the "screw" type it must not be screwed down tightly until the bottle is removed from the boiler. It is possible to test if the operation has been successfully carried out with most

types of these bottles by simply removing the spring clip or its equivalent and lifting the bottle by the edge of the lid. The lid will remain fast on the bottle, if the process has been successful, thus indicating that there is a partial vacuum inside, and that the junction between bottle and lid is perfectly airtight; but if the lid does not hold fast, the process must be repeated.

One of the advantages of this method is that, since sterilisation is carried out at a comparatively low temperature, practically no cooked flavour is imparted to the fruit and it can therefore be used as fresh fruit.

It has often been pointed out that if this method could be modified, so that ordinary bottles or jars could be used instead of the comparatively expensive special bottles, fruit bottling would become more general and profitable. As the result of a demonstration of fruit bottling, given by the Institute last summer, Mr. H. R. Howman, of Gloucester, succeeded in devising a method of utilising ordinary jars and bottles in this way, which gave promise of proving satisfactory. A series of trials was carried out by Mr. Howman privately and also, independently, at the Institute, and in both cases the results were fully equal to those obtained with the specially made bottles in a parallel series of tests. It is now ten months since the first batch of fruit was bottled, and at the time of writing the fruit is in as good condition as when it was bottled.

The principles of the process are substantially the same as in the method just described. Its distinguishing feature lies in the method of sealing the bottles.

Any jar or bottle with a fairly regular and flat rim around the mouth can be utilised. In order to effect the hermetical sealing of the bottle a flat rubber band of the same size as the rim of the bottle is required. The lid itself is simply a disc of block tin of suitable size. The bottle is filled with fruit, and water added, as in the preceding method. The subsequent treatment is also the same with the exception that neither the rubber band nor the lid are affixed, until the bottle is removed from the steriliser. Immediately the heating in the steriliser is completed, the bottle is removed and the rubber band and lid placed in position. A clamp is then adjusted so that the flat tin lid is pressed down tightly on the rubber band. Care must be taken that a perfect union is obtained with the rim; and this can easily be ascertained by inverting the bottle, when, if a leak exists, there will be signs of an escape of the water inside at that point. In practice it is found that slight inequalities on the surface of the rim do not interfere with the obtaining of an air-tight junction, since by screwing up the clamp sufficiently the thin lid

gives slightly and adjusts itself to the irregularities of the rim. The clamp is left on the bottle until the contents are quite cold. It is then removed; and one may immediately test if the bottling has been successful by raising the bottle by the edges of the lid. If the lid remains firmly attached, the contents should keep good indefinitely; while if the lid is loosened, the process must be repeated.

Thus by this method all the good points of the older method are obtained, while in addition the cost of bottling is greatly reduced owing to the possibility of utilising ordinary jars or bottles. In practice the bottles are not treated singly, but in batches, and for such cases a stand furnished with a number of screw clamps can be used.

Fuller details can be obtained by application to the Institute.

FRUIT PESTS.

It is desired to draw attention to the great loss, due to the attacks of insect and fungoid pests upon fruit trees and fruits, annually suffered by fruit growers. The prevalence and widespread distribution of many of the more serious of these diseases have made this matter a very serious one for the grower, and have at the same time rendered isolated efforts to combat them of comparatively little avail on account of re-infection from neighbouring areas of infection. During the past few years these diseases have been the subject of much study and research at the various agricultural colleges and similar institutions throughout the country; and much useful information with regard to methods of dealing with the various disorders has been gained. Useful work has also been accomplished by Agricultural Education Committees in many counties in the direction of demonstrations of spraying and other combative measures and by the dissemination of information. The Board of Agriculture, in addition to its other efforts in this direction, has recently obtained considerable powers for dealing with serious outbreaks of disease. The time appears to be ripe, therefore, for organised attempts to eradicate or, at least, to check the spread of, these disorders. Such efforts will depend for their success very largely upon the interest and co-operation of individual fruit-growers; and it is equally important that not only those who grow fruit on a large scale, but also those who have a few orchards only, or a small amount of fruit in gardens, should co-operate in the work. In order to assist them as far as possible, the Institute will willingly give to any

enquirer resident in the contributing counties information as to the nature of any diseases submitted—and the approved methods of treatment. The recent establishment of a Department of Economic Biology at University College, Bristol, in which special attention is being devoted to questions of this nature, and in conjunction with which the Institute is working, has made it possible to take up this branch of work more thoroughly than hitherto. Investigations on certain diseases are now in progress, and the comparative efficiencies of various insecticidal and fungicidal spray fluids are being tested.

Numerous specimens were submitted for examination last year, insect pests including Woolly Aphis or American Blight, *Schizoneura lanigera ;* the Black Currant Gall-mite, *Eriophyes ribis ;* the Apple Sucker, *Psylla mali ;* the Plum Aphis, *Aphis pruni ;* the Pear Midge, *Diplosis pyrivora ;* the Codling Moth, *Carpocapsa pomonella ;* the Mussel Scale, *Mytilaspis pomorum ;* the Apple Aphis, *Aphis mali ;* the Pear Leaf Blister Mite, *Eriophyes pyri ;* and the Gooseberry Sawfly, *Nematus ribesii.* Fungoid pests included Apple Canker, *Nectria ditissima ;* Apple Scab, *Fusicladium dendriticum ;* Pear Scab, *Fusicladium pirinum ;* Apple Root-rot, *Agaricus melleus ;* American Gooseberry Mildew, *Sphærotheca morsuveae ;* Gooseberry Mildew, *Microsphaera grossulariae ;* Apple Mildew, *Sphaerotheca mali ;* Apple rot, *Monilia fructigena ;* Strawberry Leaf-spot, *Sphaerella fragariae ; Botrytis sp.* on Gooseberries, Red and Black Currants ; Raspberry and Blackberry Anthracnose, *Glœosporium venetum ; Glœosporium ribis* on Currants ; *Glœosporium curvatum* on Black Currants ; and Plum Rust, *Puccinia pruni.*

APPENDIX A.—The Characters of Single Variety Ciders made in 1906-7.

Name of Variety.	Date of Making.	Specific Gravity.	Percentage of Composition of Fresh Juice.					Specific Gravity July 1, 1907.	Remarks on Characters of Ciders.
			Solids.	Total Sugar.	Malic Acid.	Tannin.	Extractives.		
Sharp Varieties.									
BRICE'S KERNEL .. (Gloucester)	Dec. 5, 1906	1.048	11.62	10.80	.70	.060	.060	1.000	A sharp, dry cider; thin and of moderate flavour. Only suited for blending for dry ciders. Fermented rapidly.
DUFFLIN (Cornwall)	Dec. 3, 1906	1.072	17.24	15.41	.91	.198	.722	1.008	A sharp, full, medium dry cider; aroma and flavour clean and good; fermented moderately slowly. Very useful for blending.
PAGE'S YELLOW APPLE (Gloucester)	Dec. 4, 1906	1.067	16.76	14.92	.58	.082	1.178	—	A medium sharp cider of good quality; aroma and flavour very fair. Could be used alone, but better blended.
YELLOW STYRE .. (Gloucester)	Dec. 4, 1906	1.075	18.70	15.91	.49	.148	2.152	—	A medium sharp, strong cider of good quality. The richness of the juice in saccharine matter is much above the average. Suitable for use alone or for blending.
Sweet Varieties.									
BELL (Somerset) ..	Dec. 8, 1906	1.058	14.42	13.24	.18	.120	.880	1.032	A very useful sweet cider of good flavour and aroma; fermented very slowly. Suitable alone or blended.
BROCK'S No I. .. (Somerset)	Nov. 19, 1906	1.051	12.66	11.19	.21	.068	1.192	1.000	A rather thin, featureless dry cider; fermenting quickly; can be used alone or blended, but of second quality.
CREMIERE	Dec. 17, 1906	1.050	12.96	11.13	.32	.074	1.436	1.000	A dry, somewhat thin cider without much character; flavour and aroma fair; can be used alone or blended. Fermented rather rapidly.

DOUH AMERE ..	Nov. 29, 1906	1.065	15.56	14.68	.27	.122	.488	1.002	A strong, dry, full-bodied cider ; flavour rather coarse ; fermented rapidly. Fairly useful alone or blended, on account of its alcoholic strength.
FREQUIN DE CHARTRES .. (Somerset)	Nov. 23, 1906	1.055	14.32	12.37	.19	.134	1.626	1.002	A dry cider of fair quality ; rate of fermentation rather rapid. Can be used alone or blended.
GREASY REDSTREAK (Somerset)	Dec. 6, 1906	1.052	13.08	12.53	.14	.176	.234	1.000	A cider of similar character to the preceding ; rather fuller in flavour ; well developed aroma.
MUSCADET .. .. (Somerset)	Nov. 5, 1906	1.062	15.48	14.46	.17	.196	.654	1.000	A dry, rather coarse-flavoured cider ; of some use alone or blended on account of its alcoholic strength ; fermented rapidly.
NOIR DE VITRY .. (Somerset)	Dec. 12, 1906	1.050	12.48	11.26	.23	.092	.898	1.002	A dry featureless cider ; can be used alone or blended.
CROFT'S No. II. .. (Somerset)	Dec. 6, 1906	1.056	13.80	13.24	.18	.100	.280	1.030	A sweet full-bodied cider ; flavour and aroma pleasant ; fermented very slowly. Can be used alone, but lacks acidity ; very useful for blending.
SMYTH-OSBOURN'S No. V. (Devon)	Nov. 20, 1906	1.059	14.80	13.05	.19	.110	1.450	1.022	A rather sweet, pleasant cider ; flavour and aroma very fair ; fermented slowly. Useful alone or blended.
SMYTH-OSBOURN'S No. VI. (Devon)	Nov. 19, 1906	1.056	14.42	12.20	.21	.076	1.934	1.002	A dry cider, with little special character ; fermented rather rapidly ; can be used alone or blended.
SMYTH-OSBOURN'S No. VII. (Devon)	Nov. 21, 1906	1.070	16.92	15.16	.23	.118	1.412	1.020	A medium sweet, agreeable cider ; flavour and aroma fair, but inclined to coarseness ; useful alone or blended This variety appears to be identical with Loram's Sweet White.

APPENDIX A.—The Characters of Single Variety Ciders made in 1906-7.

Name of Variety.	Date of Making.	Specific Gravity.	Percentage of Composition of Fresh Juice.					Specific Gravity July 1, 1907.	Remarks on Characters of Ciders.
			Solids.	Total Sugar.	Malic Acid.	Tannin.	Extractives.		
Bitter-Sweet Varieties.									
CARDIVE FORESTIER (Somerset)	Dec. 10, 1906	1.057	14.30	12.73	.30	.740	.530	1.032	A rich, sweet, very bitter cider; flavour and aroma good. Too bitter for use alone, but very useful for blending in small quantities. Fermented very slowly.
FREQUIN ROUGE .. (Devon)	Jan. 3, 1907	1.050	12.38	11.26	.32	.290	.510	1.003	A dry, mildly bitter cider of moderate quality; to be used as a mild bitter-sweet for blending.
MEDAILLE d'OR .. (Somerset)	Nov. 29, 1906	1.056	13.70	13.05	.22	.400	.030	1.002	A pronounced bitter, dry cider; very astringent, fermented more rapidly than is usual with this variety. Useful only for blending in small quantities.
MONS. JACQUES .. (Somerset)	Jan. 3, 1907	1.053	12.62	12.25	.32	.376	—	1.006	A medium bitter, dry cider; fermented at a moderate rate. Useful for blending as a medium bitter-sweet.
CROFT'S REDSTREAK (Somerset)	Dec. 8, 1906	1.058	14.68	13.06	.18	.268	1.172	1.003	A dry, mildly bitter cider; flavour and aroma very fair. A useful cider for blending. Fermented at a moderate rate.
CROFT'S No. I. .. (Somerset)	Dec. 8, 1906	1.056	14.58	13.05	.18	.250	1.1000	1.007	As preceding, but fermented more slowly.
CROFT'S No. III. .. (Somerset)	Dec. 8, 1906	1.069	16.84	15.08	.17	.206	1.384	1.012	A medium cider, with a trace of bitterness; flavour and aroma good. Very useful alone, or blended. Fermented slowly.
SMYTH-OSBOURN'S No. I. (Devon)	Nov. 21, 1906	1.056	13.94	12.05	.20	.206	1.484	1.002	A dry, mildly bitter cider of average quality. Can be used alone or blended.
SMYTH-OSBOURN'S No. II. (Devon)	Dec. 6, 1906	1.060	14.68	13.62	.18	.204	.676	1.001	Similar to preceding, but rather stronger.
SMYTH-OSBOURN'S No. III. (Devon)	Jan. 3, 1907	1.061	14.54	13.06	.19	.210	1.080	1.007	A medium dry cider, with a trace of bitterness. Quality fair; rate of fermentation moderate. Can be used alone or preferably blended.

Name of Variety.	Number of Tree.	Specific Gravity of Juice.	Percentage Composition of Juice.		Remarks on Treatment of Tree, &c.
			Malic Acid.	Tannin.	
CHISEL JERSEY	2	1.070	.24	.412	Grass removed within 3ft. radius around the tree. Rather hard pruned 1st year after planting.
Ditto ..	3	1.066	.23	.544	Grass allowed to grow to base of tree. Pruned hard 1st year after planting.
COWARNE RED	1	1.055	.54	.270	Grass removed within 4ft. 6in. radius around tree. Pruned lightly 1st year after planting.
Ditto ..	2	1.045	.60	.170	Grass removed within 3ft. radius around tree. Pruned hard 1st year after planting.
DABINET ..		1.060	.28	.276	Variety head-grafted on King of the Pippin's stem.
Ditto ..		1.055	.24	.310	Ditto. Echlinville.
Ditto ..		1.065	.24	.316	Ditto. Blenheim Orange.
Ditto ..		1.058	.20	.240	Ditto. Broad Leaf Jersey.
KNOTTED KERNEL	7	1.065	.16	.272	Grass removed within 4ft. 6in. radius around tree. Pruned hard 1st year after planting.
Ditto Ditto	8	—	.23	.108	Grass removed within 3ft. radius around tree. Root pruned. Pruned hard 1st year after planting.
MEDAILLE D'OR	1	1.055	.31	.430	Grass removed within 4ft. 6in. radius around tree. Pruned moderately 1st year after planting.
Ditto ..	2	1.060	.32	.420	Grass removed within 3ft. radius around tree. Pruned moderately 1st year after planting.
Ditto ..	4	1.056	.25	.370	Grass removed within 4ft. 6in. radius around tree. Pruned hard 1st year after planting.
Ditto ..	5	1.059	.25	.410	Grass removed within 3ft. radius around tree. Pruned lightly 1st year after planting.
Ditto ..	6	1.061	.28	.430	Grass removed within 4ft. 6in. radius around tree. Pruned hard 1st year after planting.

APPENDIX B. The Relations between the Quality of the Fruit and the Methods of Treatment of the Trees.

Name of Variety.	Number of Tree.	Specific Gravity of Juice.	Percentage Composition of Juice.		Remarks on Treatment of Tree, &c.
			Malic Acid.	Tannin.	
MEDAILLE D'OR	7	1.068	.27	.400	Grass removed within 4ft. 6in. radius around tree. Pruned lightly 1st year after planting.
Ditto ..	8	1.056	.22	.300	Grass removed within 3ft. radius around tree. Root pruned. Pruned lightly 1st year after planting.
Ditto ..	9	1.062	.28	.314	Grass removed within 3ft. radius around tree. Pruned rather hard 1st year after planting.
Ditto ..	10	1.059	.27	.310	Grass allowed to grow to base of tree. Root pruned. Pruned lightly 1st year after planting.
SKYRME'S KERNEL	1	1.058	.71	.270	Grass removed within 4ft. 6in. radius of tree. Pruned moderately 1st year after planting.
Ditto Ditto	2	1.058	.74	.250	Grass removed within 3ft. radius of tree. Pruned moderately 1st year after planting.
Ditto Ditto	3	1.054	.68	.244	Grass allowed to grow to base of tree. Pruned moderately 1st year after planting.
Ditto Ditto	4	1.051	.62	.222	Grass removed within 4ft. 6in. radius of tree. Pruned moderately 1st year after planting.
OLDFIELD ..	1	1.051	.34	.056	Grass removed within 4ft. 6in. radius of tree. Pruned moderately 1st year after planting.
Ditto ..	3	1.062	.36	.150	Grass allowed to grow to base of tree. Pruned rather hard 1st year after planting; moderately 2nd year.
Ditto ..	5	1.052	.36	.100	Grass removed within 3ft. radius of tree. Pruned rather hard 1st year after planting.
Ditto ..	4	1.050	.37	.110	Grass removed within 4ft. 6in. radius of tree. Pruned moderately 1st year after planting.

Name of Variety.	Specific Gravity.	Percentage Composition of Juice.			Grower.	District.
		Total Sugar. Approximate.	Malic Acid.	Tannin.		
APPLES.						
ALLSPICE	1.056	11.5 —13.5	.12	.226	W. Mann	Littlehempston D.
ASHTON BITTER WHITE ..	1.051	10.25 12.25	.18	.350	Cider Institute	Long Ashton S.
ASHTON EARLY RED JERSEY	1.055	11.25—13.25	.16	.330	Ditto.	Ditto.
ASHTON WHITE	1.053	10.75—12.75	.22	.420	Ditto.	Ditto.
BELL	1.058	12. —14	.20	.126	W. Mann	Littlehempston D.
BLOODY BUTCHER	1.056	11.5 —13.5	.92	.136	Archdeacon Brymer ..	Charlton Mackrell S.
BLUSHING BRIDE	1.061	12.75—14.75	.12	.148	W. Mann	Littlehempston D.
BROWN JERSEY	1.050	10 —12	.14	.192	C. Osborn	Woolston S.
Do. Do.	1.064	13.5 —15.5	.20	.352	H. J. Davis	Sutton Montis S.
BRUFORD'S No. I.	1.057	11.75—13.75	.55	.104	R. Bruford	Taunton S.
Do. No. II.	1.057	11.75—13.75	.36	.100	Do.	Do.
BUTLEIGH No. X.	1.059	12.25—14.25	.18	.170	R. Neville-Grenville ..	Butleigh S.
Do. No. XI.	1.057	11.75—13.75	.13	.310	Do.	Do.
Do. No. XII.	1.061	12.75—14.75	.24	.410	Do.	Do.
Do. No. XIV.	1.086	19 —21	.16	.324	Do.	Do.
Do. No. XVII. ..	1.062	13 —15	1.02	.432	Do.	Do.
BUTTERBOX	1.054	11 —13	.68	.220	J. W. F. Bickford ..	Bickington D.
CADBURY	1.068	14.5 —16.5	.33	.244	C. Osborn	Woolston S.
CADBURY No. 2	1.054	11 —13	.23	.270	Do.	Do.
CAP OF LIBERTY	1.060	12.5 —14.5	1.06	.346	Do.	Do.
CARDIVE FORESTIER ..	1.052	10.5 —12.5	.28	.550	J. Watts	Backwell S.
CHISEL JERSEY	1.069	14.75—16.75	.19	.302	H. J. Davis	Sutton Montis S.
Do. Do.	1.057	11.75—13.75	.22	.496	C. Osborn	Woolston S.
CIDER PEARMAIN	1.060	12.5 —14.5	.44	.198	Do.	Do.
CIDER SPICE	1.051	10.25—12.25	.52	.108	Do.	Do.

APPENDIX C.—Analyses of Apples and Pears, 1907 8.—*continued.*

Name of Variety.	Specific Gravity.	Percentage Composition of Juice.			Grower.	District.	
		Total Sugar. Approximate.	Malic Acid.	Tannin.			
APPLES—*continued.*							
CORTON	1.046	9 —11	.15	.168	C. Willis	Martock	S.
COURT ROYAL	1.061	12.75—14.75	.22	.144	R. Neville-Grenville ..	Butleigh	S.
CREMIERE	1.052	10.5 —12.5	.24	.130	J. Watts	Backwell	S.
CULVERY							
BITTERSWEET, No. I. ..	1.058	12 —14	.28	.352	J. W. F. Bickford ..	Bickington	D.
Do. Do. No. II. ..	1.052	10.5 —12.5	.14	.268	Do.	Do.	
DAGG'S APPLE	1.044	8.5 —10.5	.56	.094	J. Watts	Backwell	S.
DAVIS' FAVOURITE	1.053	10.75—12.75	.18	.336	H. J. Davis	Sutton Montis	S.
DOUCE AMERE	1.049	9.75—11.75	.23	.108	J. Watts	Backwell	S.
DOVE	1.059	12.25—14.25	.21	.108	C. Osborn	Woolston	S.
Do.	1.049	9.75—11.75	.14	.268	H. J. Davis	Sutton Montis	S.
ECARLATINE	1.050	10 —12	.12	.106	J. Watts	Backwell	S.
FAIR MAID OF DEVON ..	1.050	10 —12	.66	.148	W. Mann	Littlehempston	D.
FILL BARREL	1.069	14.75—16.75	.26	.480	C. Osborn	Woolston	S.
Do. Do.	1.063	13.25—15.25	.34	.304	H. J. Davis	Sutton Montis	
FRENCH REINETTE	1.054	11 —13	.13	.200	W. Mann	Littlehempston	D.
FROGINGTON GLORY ..	1.071	15.25—17.25	.32	.270	C. Osborn	Woolston	S.
GEORGE JAHMES	1.062	13 —15	.17	.274	Do.	Do.	
GLASTONBURY	1.045	8.75—10.75	.22	.244	J. Wall	Wedmore	S.
GREEN JERSEY	1.056	11.5 —13.5	.22	.166	H. J. Davis	Sutton Montis	S.
GUERNSEY	1.047	9.25—11.25	.17	.162	J. T. Hebditch	South Petherton	S.
HANGDOWN	1.043	8.25—10.25	.22	.144	J. M. Pope	Spence Combe	D.
HARDING'S No. I.	1.058	12 —14	.20	.375	R. Harding	Long Ashton	S.
HARDING'S APPLE	1.036	6.5 — 8.5	.20	.176	J. Wall	Wedmore	S.
HARD SWEET NATURAL ..	1.056	11.5 —13.5	.69	.134	J. W. F. Bickford ..	Bickington	D.

HEBDITCH'S BITTERSWEET	1.055	11.25—13.25	.20	.380	J. T. Hebditch ..	South Petherton	S.
HEBDITCH'S SWEET; ..	1.042	8 —10	.21	.160	Do.	Do. Do.	
HELEN'S PARK BITTERSWEET	1.053	10.75—12.75	.34	.604	J. W. F. Bickford ..	Bickington	D.
HOBBS' JERSEY	1.072	15.5 —17.5	.18	.560	C. Osborn	Woolston	S.
Do. Do.	1.056	11.5 —13.5	.14	.242	H. J. Davis	Sutton Montis	S.
HORNER	1.056	11.5 —13.5	.18	.226	J. H. Symes	Martock	S.
Do.	1.062	13 —15	.18	.296	C. Osborn	Woolston	S.
HORWOOD'S SEEDLING ..	1.042	8 —10	.21	.376	Do.	Do.	S.
IMPROVED HORNER	1.061	12.75—14.75	.18	.236	J. Wall	Wedmore	W.
ITALY	1.052	10.5 —12.5	.37	.340	E. V. V. Wheeler ..	Tenbury	S.
JONES' SEEDLING	1.055	11.25—13.25	.36	.224	Cider Institute	Long Ashton	D.
KILLINCH BITTER-SWEET ..	1.048	9.5 —11.5	.14	.104	J. W. F. Bickford ..	Bickington	D.
KINGSTON BLACK	1.058	12 —14	.56	.208	C. Osborn	Woolston	S.
Do. Do.	1.057	11.75—13.75	.34	.120	W. Mann	Littlehempston	D.
Do. Do.	1.056	11.55—13.5	.46	.176	J. T. Hebditch	South Petherton	S.
LADY FLOWER	1.075	16.25—18.25	.58	.132	Cider Institute	Long Ashton	S.
LAMBROOK PIPPIN	1.053	10.75—12.75	.58	.216	J. H. Symes	Martock	S.
LASCOMBE'S	1.042	8 —10	.30	.116	J. M. Pope	Spence Combe	D.
LATE BLOWER	1.061	12.75—14.75	.16	.096	W. Mann	Littlehempston	D.
LEA'S No. I.	1.074	16 —18	.32	.262	Rev. E. E. Lea ..	Tenbury	W.
LONG NOSE	1.056	11.5 —13.5	.16	.084	J. T. Hebditch ..	South Petherton	S.
LONG STEM	1.055	11.25—13.25	.22	.816	C. Osborn	Woolston	S.
MASTER'S JERSEY	1.061	12.75—14.75	.15	.580	Do.	Do.	S.
Do. Do.	1.054	11 —13	.27	.360	H. J. Davis	Sutton Montis	S.
MEDAILLE D'OR	1.070	15 —70	.50	.620	Do.	Do. Do.	S.
Do. Do.	1.056	11.5 —13.5	.22	.244	J. Watts	Backwell	S.
MIDDLE STREAK	1.052	10.5 —12.5	.16	.560	C. Osborn	Woolston	S.
MONS. JACQUES	1.051	10.25—12.25	.28	.416	J. Watts..	Backwell	S.
MORGAN SWEET	1.051	10.25—12.25	.23	.300	Cider Institute	Long Ashton	S.
NEVERBLIGHT	1.062	13 —15	.19	.216	R. Neville-Grenville ..	Butleigh	S.
Do.	1.040	7.5 — 9.5	.62	.232	J. Wall	Wedmore	W.
Do.	1.056	11.5 —13.5	.57	.306	C. Osborn	Woolston	S.
PHILIP NORMAN	1.051	10.25—12.25	.20	.228	H. J. Davis	Sutton Montis	S.

APPENDIX C.—Analyses of Apples and Pears, 1907-8.—*continued.*

Name of Variety.	Specific Gravity.	Percentage Composition of Juice.			Grower.	District.	
		Total Sugar. Approximate.	Malic Acid.	Tannin.			
APPLES—*continued.*							
PHILIP NORMAN	1.052	10.5 —12.5	.24	.242	C. Osborn	Woolston	S.
POCKET	1.052	10.5 —12.5	.15	.320	J. W. F. Bickford ..	Bickington	D.
POLE-CAREW'S No. XII. ..	1.084	18.5 —20.5	.66	.180	C. E. Pole-Carew ..	Littlehempston	D.
POMMIER BEDAN	1.052	10.5 —12.5	.18	.170	J. Watts	Backwell	S.
POMMIER BINET GRIS ..	1.054	11 —13	.20	.180	Do.	Do.	
PORTER'S PERFECTION ..	1.048	9.5 —11.5	.62	.208	C. Porter	South Petherton	S.
PORT WINE	1.062	13 —15	.18	.258	C. Osborn	Woolston	S.
Do. Do.	1.058	12 —14	.18	.424	H. J. Davis	Sutton Montis	S.
PRINCE ALBERT	1.057	11.75—13.75	.19	.300	J. Shipp	Breadstone	G.
RED JERSEY	1.058	12 —14	.30	.230	H. J. Davis	Sutton Montis	S.
REDSTREAK	1.062	13 —15	.15	.460	C. Osborn	Woolston	S.
REINE DES POMMES	1.061	12.75—14.75	.21	.418	J. Watts	Backwell	S.
ROUGE DE TREVES	1.049	9.75—11.75	.70	.094	Do.	Do.	
Do. Do.	1.054	11 —13	.89	.120	Cider Institute ..	Long Ashton	S.
ROYAL JERSEY	1.064	13.5 —15.5	.21	.548	C. Osborn	Woolston	S.
Do. Do.	1.072	15.5 —17.5	.21	.440	H. J. Davis	Sutton Montis	S.
SANDFORD JERSEY SEEDLING	1.068	14.5 —16.5	.18	.392	C. Osborn	Woolston	S.
SHARPE'S MIDSUMMER ..	1.062	13 —15	.74	.086	Cider Institute	Long Ashton	S.
SHEEP'S NOSE	1.062	13 —15	.29	.358	H. J. Davis	Sutton Montis	S.
SILVER CUP	1.074	16 —18	.13	.324	Do.	Do.	D.
Do. Do.	1.075	16.25—18.25	.16	.342	C. Osborn	Woolston	S.
SLACK-MA-GIRDLE	1.045	8.75—10.75	.12	.132	G. Ash	Newton St. Cyres	D.
SLATTER'S No. I.	1.043	8.25—10.25	.85	.090	J. Slatter	Paxford	W.
Do. No. II.	1.047	9.25—11.25	.53	.096	Do.	Do.	

SOUR CADBURY	1.053	10.75—12.75	.76	.196	C. Osborn	Woolston	S.
STONE DOVE	1.056	11.5 —13.5	.16	.342	Do.	Do.	
STONE PIPPIN	1.070	15 —17	.25	.174	W. Mann	Littlehempston	D.
STRAWBERRY NORMAN ..	1.055	11.25—13.25	.32	.324	Cider Institute	Long Ashton	S.
SWEET ALFORD	1.053	10.75—12.75	.20	.150	G. Ash	Newton St. Cyres	D.
Do. Do.	1.060	12.5 —14.5	.15	.110	W. Mann	Littlehempston	D.
SWEET COPPIN	1.064	13.5 —15.5	.20	.120	Do.	Do.	
SWEET FLOWERING	1.067	14.25—16.25	.11	.274	Do.	Do.	
SWEET HARCOMBE	1.054	11 —13	.17	.270	C. Osborn	Woolston	S.
SWEET PIPPIN	1.053	10.75—12.75	.19	.122	Do.	Do.	
TANNERS	1.074	16 —18	.22	.880	R. Neville-Grenville ..	Butleigh	S.
TAYLOR'S BITTER	1.053	10.75—12.75	.18	.208	C. Porter	South Petherton	S.
TINCHAM'S BITTER	1.048	9.5 —11.5	.14	.306	J. W. F. Bickford ..	Bickington	D.
TOMMY HUNT	1.058	12 —14	.32	.212	H. J. Davis	Sutton Montis	S.
TOMMY RODFORD	1.048	9.5 —11.5	.24	.280	J. H. Symes	Martock	S.
Do. Do.	1.043	8.25—10.25	.22	.238	Do.	Do.	
TREMLITT'S BITTER	1.060	12.5 —14.5	.29	.600	W. Mann		
TRUCKLE Do.	1.051	10.25—12.25	.19	.272	J. H. Symes	Martock	S.
VIRGIN	1.060	12.5 —14.5	.51	.600	C. Osborn	Woolston	
WESLEYAN	1.058	12 —14	.92	.140	E. D. Till	Eynsford, Kent	
WHEELER'S No. I.	1.052	10.5 —12.5	.24	.268	E. V. V. Wheeler ..	Tenbury	W.
WHITE CLOSE PIPPIN ..	1.058	12 —14	.15	.170	H. J. Davis	Sutton Montis	S.
WHITE JERSEY	1.068	14.5 —16.5	.18	.296	C. Osborn	Woolston	S.
Do. Do.	1.052	10.5 —12.5	.14	.250	H. J. Davis	Sutton Montis	S.
WHITE'S BITTER	1.056	11.5 —13.5	1.8	.170	W. Mann	Littlehempston	D.
WILLIS' FAVOURITE	1.048	9.5 —11.5	.16	.196	C. Willis	Martock	S.
WOODBINE	1.051	10.25—12.25	.20	.194	G. Ash	Newton St. Cyres	D.
WOOLSTON GREENING ..	1.055	11.25—13.25	.14	.214	C. Osborn	Woolston	S.
YARLINGTON MILL	1.045	8.75—10.75	.18	.234	H. J. Davis	Sutton Montis	S.
Do. Do.	1.054	11 —13	.19	.338	C. Osborn	Woolston	S.
YEOVIL SOUR	1.050	10 —12	.42	.100	J. H. Symes	Martock	S.
ASHTON No. 57	1.052	10.5 —12.5	1.01	.530	Cider Institute	Long Ashton	S.
Do. No. 69	1.040	7.5 — 9.5	.76	.140	Do.	Do.	

APPENDIX C.—Analyses of Apples and Pears, 1907-8.—*continued.*

Name of Variety.	Specific Gravity.	Percentage Composition of Juice.			Grower.	District.
		Total Sugar. Approximate.	Malic Acid.	Tannin.		
APPLES—*continued.*						
ASHTON No. 78	1.045	8.75—10.75	.54	.210	Cider Institute	Long Ashton
Do. No. 101	1.039	7.25— 9.25	1.27	.480	Do.	Do.
Do. No. 102	1.055	11.25—13.25	.15	.340	Do.	Do.
Do. No. 123	1.045	8.75—10.75	.78	.090	Do.	Do.
Do. No. 130	1.059	12.25—14.25	.58	.096	Do.	Do.
Do. No. 131	—	—	.19	.284	Do.	Do.
Do. No. 134	1.053	10.75—12.75	.17	.362	Do.	Do.
Do. No. 137	1.050	10 —12	.29	.280	Do.	Do.
Do. No. 138	1.057	11.75—13.75	.38	.880	Do.	Do.
Do. No. 149	1.055	11.25—13.25	1.50	.440	Do.	Do.
Do. No. 154	1.054	11 —13	1.65	.286	Do.	Do.
Do. No. 156	1.057	11.75—13.75	.68	.196	Do.	Do.
Do. No. 165	1.044	8.5 —10.5	.94	.172	Do.	Do.
Do. No. 167	1.065	13.75—15.75	1.41	.300	Do.	Do.
Do. No. 172	1.055	11.25—13.25	.76	.182	Do.	Do.
Do. No. 178	1.044	8.5 —10.5	.19	.110	Do.	Do.
Do. No. 181	1.042	8. —10	1.20	.344	Do.	Do.
Do. No. 190	1.046	9 —11	.30	.312	Do.	Do.
Do. No. 194	1.057	11.75—13.75	.136	.540	Do.	Do.
PEARS.						
AMPHLETT'S No. I.	1.065	13.75—15.75	.22	.020	R. H. Amphlett ..	Droitwich W.
BLAKENEY RED	1.045	8.75—10.75	.51	.046	A. T. Price	Berkeley G.
RADCLIFFE-COOKE'S No. I.	1.058	12 —14	.13	.070	C. W. Radcliffe-Cooke..	Hellens H.
Do. Do. No. II.	1.053	10.75—12.75	.74	.206	Do.	Do.
RED PEAR	1.044	8.5 —10.5	.38	.060	R. H. Cazalet	Castlemorton W.
SPICE	1.053	10.75—12.75	.63	.080	Do.	Do.

REPORT BY JOHN ETTLE, F.R.H.S.

THE ORCHARDS.

The "Hereford" trees in the young orchard have continued to grow satisfactorily, and several of them—Cowarne Red, Chisel Jersey, Knotted Kernel, Skyrme's Kernel and Medaille d'Or—have borne good crops of fruit in quantities sufficient for analysis. The Medaille d'Or carried such heavy crops that the branches had to be tied up to support them. In the deep red loam this variety has grown very well indeed besides being very prolific. Of the "Somersets," those in the row of Dabinets mentioned in the last report as being head grafted on about twenty different intermediate stems have nearly all borne crops of fruit, those grafted on Ecklinville, King of Pippins, Blenheim Orange, and Broad-leaf Jersey giving enough to analyse. The Oldfield Pears also gave a fairly good crop.

Measurements of the girths of all trees in this orchard were taken on a corresponding date to last year, the girths being taken at a height of 5ft. 6in. from the soil. The average increase in size is about one inch. Those trees which had the cultivated soil round them extended to a 4ft. 6in. radius have made appreciably more growth than those which were kept to the original 3ft., and the latter show more growth than those which were allowed to grass over. This, of course, was to be expected, but the experiment has not shown such positive results as it would on trees planted in a poorer soil. It is probable that the trees, where the grass was allowed to grow round them, will be the better in a few years time as the growth is more sturdy and short jointed. The checking of the growth of stems of trees cut back for head grafting is shown on a batch of Broad-leaf Jerseys, a part of which were grafted in 1906 and the others left to produce their own fruit. The latter increased in girth about an inch and the former only from a quarter to a half inch. The influence of roots of elm trees on the growth of young trees is still very noticeable, as those near the elms are not more than half and in some cases only a quarter the size of similar varieties in other parts of the field.

The old orchard did not produce a good crop of fruit last season. About half the trees were pruned and the others left for demonstration purposes.

THE PLANTATIONS.

In plantation No. 1 (the first planted), most of the apples cropped fairly well, but a heavy hail storm in the middle of July almost entirely spoilt the fruit, especially such large and rather soft varieties as Suffields, Ecklinvilles and Grosvenors. Lane's Prince Albert bore well and being a harder apple was not so much bruised. Beauty of Bath and Worcester Pearmain of the dessert varieties also did well, but as a lot of the fruit was stolen no accurate record of weights produced could be made.

The scheme of experiments in pruning is being carried on, but measurements of growths, etc., have not yet been taken.

Aphides and Fusicladium have been very troublesome. The season being so wet, insecticides and fungicides had scarcely time to dry on, so that the next shower washed a good deal of them off.

The strawberries in this plantation fruited fairly well and were then rooted out. The wet weather and shade of the fruit trees did not improve them, but they served their purpose as a "catch" crop. The Raspberries, Red and White Currants and Gooseberries did very well, but the Black Currants were almost entirely spoilt by the fungus—*Glœosporium curvatum*. There had been no experience of this pest in the district before, and as the leaves were slightly infested with aphides it was thought these were doing the injury. Just at the time the fruit was beginning to ripen and it was thought spraying might be deferred till it was gathered, but only a small portion ripened, the rest shrivelling up. All the trees have been burnt excepting a few which have been isolated for experimenting on. There will also be an opportunity for experimenting on "big bud."

The heaviest croppers in this plantation were Royal Sovereign Strawberry; Superlative Raspberry; Fay's Prolific Red, Carter's Champion Black, and White Dutch Currants respectively. The same number of bushes of White gave 30 lbs. more fruit than the red.

In plantation No. 2 the trees and bushes planted two years ago are all growing satisfactorily. An experiment with Strawberry plants taken from "first" and "second" runners respectively has been decidedly in favour of the firsts, which produced more than double the weight of fruit from the seconds. (The first and second mean the first from the parent plant, the second being the next produced on the same stem.) This experiment will be continued this year.

The other half acre in this plantation was planted last season with a collection of Plums, Pears, Raspberries, Red, White and Black Currants, with Strawberries in between.

THE NURSERY.

There will be a batch of several thousands of fine four years old trees of Perry Pears and Cider Apples ready next planting season for distributing to the County Councils supporting the Institute, so that they may form experimental orchards which may also be used for demonstration purposes. There is a great variation in the growth of different varieties, some making splendid stems without training, others doing not too well and having to be straightened by bamboo canes. This shows that the "Somerset" system, that is planting (in orchards) varieties which have good stems and heads to be afterwards re-grafted in the heads, is a good one for poor growing varieties.

The apples on the Paradise stock, mentioned on page 180 (last Journal) have been planted out 10ft. apart. They would have been planted last season but the land was foul with weeds, so it was fallowed. In the splendid weather in September a "Planet Junior" horse hoe was kept busy and the weeds were pretty well destroyed.

The greater part of another half acre has been planted as a nursery with seedling crab, seedling apple, seedling pear and paradise stocks.

WEIGHTS OF SMALL FRUITS, 1907.

No. 1 Plantation.

STRAWBERRIES.

Name of Variety.	1st Quality.	2nd Quality.	Total lbs.
Royal Sovereign	195½ ..	65 ..	260½
President	173 ..	71 ..	244
Vicomtesse H. de Thury ..	41 ..	157 ..	198
Monarch	141½ ..	55¾ ..	169¼
Latest of All	61½ ..	15 ..	76½
Noble	50 ..	23½ ..	73½
Sir J. Paxton	41½ ..	10 ..	51½
Waterloo	17½ ..	— ..	17½

GOOSEBERRIES (1-16th of an Acre each).

Keepsake	313½
Crown Bob	197
Lancashire Lad	141
Whinham's Industry	133

RED CURRANTS (1-16th of an Acre each).

Fay's Prolific	126
Knight's Sweet Red	97
Raby Castle	92¾

WHITE CURRANTS.

White Dutch	155

BLACK CURRANTS (1-16th of an Acre each).

Carter's Champion..	56½
Black Naples	40
Lee's Prolific	34
Baldwin's..	27

RASPBERRIES (1-16th of an Acre each).

Superlative	283¼
Norwich Wonder	274½
Northumberland Fillbasket	266½
Hornet	244½

No. 2 PLANTATION.

RASPBERRIES (120 plants of each).

	lbs.
Baumforth Seedling	56¾
Semper Fidelis	55¾
White Magnum Bonum	55¼
Yellow Antwerp	45¾
Red Antwerp	30
Carter's Prolific	22¾

GOOSEBERRIES.

(10 bushes of each).	lbs.	(20 bushes of each).	lbs.
Diadem	8¼	King of Trumps ..	27½
Red Warrington ..	7	Surprise	25
Gretna Green ..	6¼	Leveller	24¾
Victoria	6	Fascination ..	22¼
Thatcher	5¾	Careless	22¼
Golden Gem ..	5¼	Telegraph	17¾
Langley Gage ..	5¼	Leader	16¾
High Sheriff ..	3½	Faithful	12¾
Ringer	3½	Red Warrington ..	10
Dan's Mistake ..	2½	Falstaff	8¼
Hero of Nile ..	2¼	May Duke	7½
Red Champagne ..	2	Blucher	6¾
		Mount Pleasant ..	4½